© 2001, Mercury Marine

Gasoline Engines - 496 MAG Bravo Models

CA940

Identification Record

PLEASE RECORD THE FOLLOWING INFORMATION:

1.			
	Engine Model and Horsepower		Engine Serial Number
2.			
	Transom Assembly Serial Number (Sterndrive)	Gear Ratio	Sterndrive Unit Serial Number
3.			
	Transmission Model (Inboard)	Gear Ratio	Transmission Serial Number
4.			
	Propeller Number	Pitch	Diameter
5.			
	Hull Identification Number (HIN)		Purchase Date
6.			
	Boat Manufacturer	Boat Model	Length
7.			
	Exhaust Gas Emissions Certificate Number (Europe Only)		

SERIAL NUMBERS

The serial numbers are the manufacturer’s keys to numerous engineering details which apply to your Mercury MerCruiser® power package. When contacting your Authorized Mercury MerCruiser Dealer about service, **always specify model and serial numbers.**

The description and specifications contained herein were in effect at the time this guide was approved for printing. Mercury Marine, whose policy is one of continuous improvement, reserves the right to discontinue models at any time, or to change specifications or designs, without notice and without incurring obligation.

Mercury Marine, Fond du Lac, Wisconsin, U.S.A. Printed in U.S.A.

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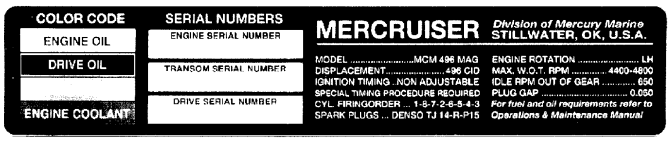

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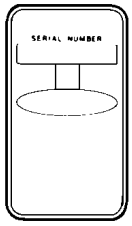

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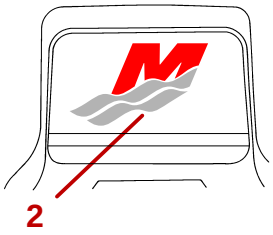

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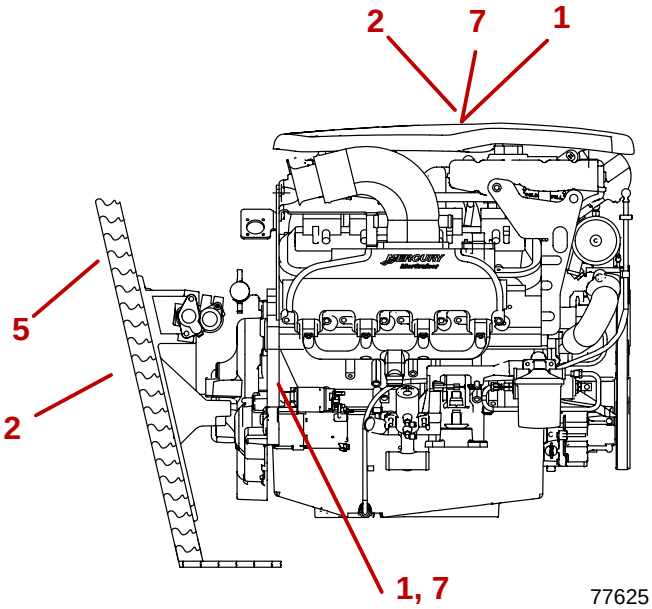

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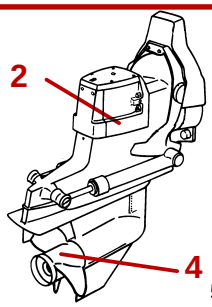

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CA859

Welcome!

You have selected one of the finest marine power packages available. It incorporates numerous design features to assure operating ease and durability.

With proper care and maintenance, you will thoroughly enjoy using this product for many boating seasons. To ensure maximum performance and carefree use, we ask that you thoroughly read this manual.

The Operation, Maintenance and Warranty Manual contains specific instructions for using and maintaining your product. We suggest that this manual remain with the product for ready reference whenever you are on the water.

Thank you for purchasing one of our Mercury MerCruiser products. We sincerely hope your boating will be pleasant!

Consumer Affairs Department

CA741

Warranty Message

The product you have purchased comes with a **limited warranty** from Mercury Marine; the terms of the warranty are set forth in the *Warranty* Sections of this manual. The warranty statement contains a description of what is covered, what is not covered, the duration of coverage, how to best obtain warranty coverage, **important disclaimers and limitations of damages**, and other related information. Please review this important information.

CA961

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Warranty Information

Owner Warranty Registration

UNITED STATES AND CANADA ONLY

- It is important that your selling dealer fills out the Warranty Registration Card completely and mails it to the factory immediately upon sale of the new product.
- It identifies name and address of the original purchaser, product model and serial number(s), date of sale, type of use and selling dealer’s code, name and address. The dealer also certifies that you are the original purchaser and user of the product.
- Upon receipt of the Warranty Registration Card at the factory, you will be issued a plastic Owner Warranty Registration Card which is your only valid registration identification. It must be presented to the servicing dealer should warranty service be required. Warranty claims will not be accepted without presentation of this card.
- A temporary Owner Warranty Registration Card will be presented to you when you purchase the product. It is valid only for 30 days from date of sale while your plastic Owner Warranty Registration Card is being processed. Should your product need service during this period, present the temporary registration card to the dealer. He will attach it to your warranty claim form.
- Because of your selling dealer’s continuing personal interest in your satisfaction, the product should be returned to him for warranty service.
- If your plastic card is not received within 30 days from date of new product sale, please contact your selling dealer.
- The product warranty is not effective until the product is registered at the factory.
- NOTICE: Registration lists must be maintained by factory and dealer on marine products sold in the United States, should notification under the Federal Boat Safety Act be required.

International Owner Registration

OUTSIDE THE UNITED STATES AND CANADA

- It is important that your selling dealer fills out the Warranty Registration Card completely and mails it to the distributor or Marine Power Service Center responsible for administering the warranty registration/claim program for your area.
- The Warranty Registration Card identifies your name and address, product model and serial number(s), date of sale, type of use and the selling distributor's/dealer's code number, name and address. The distributor/dealer also certifies that you are the original purchaser and user of the product.
- A copy of the Warranty Registration Card, designated as the "Purchaser's Copy", MUST be given to you immediately after the card has been completely filled out by the selling distributor/dealer. This card represents your factory registration identification, and should be retained by you for future use when required. Should you ever require warranty service on this product, your dealer may ask you for the Warranty Registration Card to verify date of purchase and to use the information on the card to prepare the warranty claim form(s).
- In some countries, the Marine Power Service Center will issue you a permanent (plastic) Warranty Registration Card within 30 days after receiving the "Factory Copy" of the Warranty Registration Card from your distributor/dealer. If you receive a plastic Warranty Registration Card, you may discard the "Purchaser's Copy" that you received from the distributor/dealer when you purchased the product. Ask your distributor/dealer if this plastic card program applies to you.
- For further information concerning the Warranty Registration Card and its relationship to Warranty Claim processing, refer to the "International Warranty." Refer to "Table of Contents."

IMPORTANT: Registration lists must be maintained by the factory and dealer in some countries by law. It is our desire to have ALL products registered at the factory should it ever be necessary to contact you. Make sure your dealer/distributor fills out the warranty registration card immediately and sends the factory copy to the Marine Power International Service Center for your area.

CC1048

Warranty Policies

Mercury MerCruiser One Year Limited Warranty (Gasoline Fueled Products Only)

WHAT IS COVERED

Mercury Marine warrants its new products to be free of defects in material and workmanship during the period described below.

DURATION OF COVERAGE

This Limited Warranty provides coverage for either one (1) year from the date the product is first sold to a recreational use retail purchaser, or the date on which the product is first put into service, whichever occurs first. Commercial users of these products receive warranty coverage of either one (1) year from the date of first retail sale, or the accumulation of 500 hours of operation, whichever occurs first. Commercial use is defined as any work or employment related use of the product, or any use of the product which generates income, for any part of the warranty period, even if the product is only occasionally used for such purposes. The repair or replacement of parts, or the performance of service under this warranty, does not extend the life of this warranty beyond its original expiration date. Unexpired warranty coverage can be transferred from one recreational use customer to a subsequent recreational use customer upon proper re-registration of the product. Unexpired warranty coverage cannot be transferred either to or from a commercial use customer.

CONDITIONS THAT MUST BE MET IN ORDER TO OBTAIN WARRANTY COVERAGE

Warranty coverage is available only to retail customers that purchase from a Dealer authorized by Mercury Marine to distribute the product in the country in which the sale occurred, and then only after the Mercury Marine specified pre-delivery inspection process is completed and documented. Warranty coverage becomes available upon proper registration of the product by the authorized dealer. Inaccurate warranty registration information regarding recreational use, or subsequent change of use from recreational to commercial (unless properly re-registered) may void the warranty at the sole discretion of Mercury Marine. Routine maintenance outlined in the Operation and Maintenance Manual must be timely performed in order to obtain warranty coverage. Mercury Marine reserves the right to make any warranty coverage contingent upon proof of proper maintenance.

WHAT MERCURY WILL DO

Mercury’s sole and exclusive obligation under this warranty is limited to, at our option, repairing a defective part, replacing such part or parts with new or Mercury Marine certified re-manufactured parts, or refunding the purchase price of the Mercury product. Mercury reserves the right to improve or modify products from time to time without assuming an obligation to modify products previously manufactured.

HOW TO OBTAIN WARRANTY COVERAGE

The customer must provide Mercury with a reasonable opportunity to repair, and reasonable access to the product for warranty service. Warranty claims shall be made by delivering the product for inspection to a Mercury dealer authorized to service the product. If purchaser cannot deliver the product to such a dealer, written notice must be given to Mercury. We will then arrange for the inspection and any covered repair. Purchaser in that case shall pay for all related transportation charges and/or travel time. If the service provided is not covered by this warranty, purchaser shall pay for all related labor and material, and any other expenses associated with that service. Purchaser shall not, unless requested by Mercury, ship the product or parts of the product directly to Mercury. The warranty registration card is the only valid registration identification and must be presented to the dealer at the time warranty service is requested in order to obtain coverage.

WHAT IS NOT COVERED

This limited warranty does not cover routine maintenance items, tune ups, adjustments, normal wear and tear, damage caused by abuse, abnormal use, use of a propeller or gear ratio that does not allow the engine to run in its recommended RPM range (see the Operation and Maintenance Manual), operation of the product in a manner inconsistent with the recommended operation/duty cycle section of the Operation and Maintenance Manual, neglect, accident, submersion, improper installation (proper installation specifications and techniques are set forth in the installation instructions for the product), improper service, use of an accessory or part which damages the Mercury product and was not manufactured or sold by us, jet pump impellers and liners, operation with fuels, oils or lubricants which are not suitable for use with the product (see the Operation and Maintenance Manual), alteration or removal of parts, water entering the engine through the fuel intake, air intake or exhaust system or damage to the product from insufficient cooling water caused by blockage of the cooling system by a foreign body, running the engine out of water, mounting the engine too high on the transom, or running the boat with the engine trimmed out too far. Use of the product for racing or other competitive activity, or operating with a racing type lower unit, at any point, even by a prior owner of the product, voids the warranty.

Expenses related to haul-out, launch, towing, storage, telephone, rental, inconvenience, slip fees, insurance coverage, loan payments, loss of time, loss of income, or any other type of incidental or consequential damages are not covered by this warranty. Also, expenses associated with the removal and/or replacement of boat partitions or material caused by boat design for access to the product are not covered by this warranty.

No individual or entity, including Mercury Marine authorized dealers, has been given authority by Mercury Marine to make any affirmation, representation or warranty regarding the product, other than those contained in this limited warranty, and if made, shall not be enforceable against Mercury Marine.

DISCLAIMERS AND LIMITATIONS

THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY DISCLAIMED. TO THE EXTENT THAT THEY CANNOT BE DISCLAIMED, THE IMPLIED WARRANTIES ARE LIMITED IN DURATION TO THE LIFE OF THE EXPRESS WARRANTY. INCIDENTAL AND CONSEQUENTIAL DAMAGES ARE EXCLUDED FROM COVERAGE UNDER THIS WARRANTY. SOME STATES/COUNTRIES DO NOT ALLOW FOR THE DISCLAIMERS, LIMITATIONS AND EXCLUSIONS IDENTIFIED ABOVE, AS A RESULT, THEY MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER LEGAL RIGHTS WHICH VARY FROM STATE TO STATE AND COUNTRY TO COUNTRY.

CC1049

3 Year Limited Warranty Against Corrosion (Worldwide)

WHAT IS COVERED

Mercury Marine warrants that each new Mercury, Mariner, Mercury Racing, Sport Jet, M^2 Jet Drive, Tracker by Mercury Marine Outboard, MerCruiser Inboard or sterndrive engine (Product) will not be rendered inoperative as a direct result of corrosion for the period of time described below.

DURATION OF COVERAGE

This limited corrosion warranty provides coverage for three (3) years from either the date the product is first sold, or the date on which the product is first put into service, whichever occurs first. The repair and replacement of parts, or the performance of service under this warranty does not extend the life of this warranty beyond its original expiration date. Unexpired warranty coverage can be transferred to subsequent (noncommercial use) purchaser upon proper re-registration of the product.

CONDITIONS THAT MUST BE MET IN ORDER TO OBTAIN WARRANTY COVERAGE

Warranty coverage is available only to retail customers that purchase from a Dealer authorized by Mercury Marine to distribute the product in the country in which the sale occurred, and then only after the Mercury Marine specified pre-delivery inspection process is completed an documented. Warranty coverage becomes available upon proper registration of the product by the authorized dealer. Corrosion prevention devices specified in the Operation and Maintenance Manual must be in use on the boat, and routine maintenance outlined in the Operation and Maintenance Manual and must be timely performed (including without limitation the replacement of sacrificial anodes, use of specified lubricants, and touch-up nicks and scratches) in order to maintain warranty coverage. Mercury Marine reserves the right to make warranty coverage contingent upon proof of proper maintenance.

WHAT MERCURY WILL DO

Mercury’s sole and exclusive obligation under this warranty is limited to, at our option, repairing a corroded part, replacing such part or parts with new or Mercury Marine certified re-manufactured parts, or refunding the purchase price of the Mercury product. Mercury reserves the right to improve or modify products from time to time without assuming an obligation to modify products previously manufactured.

HOW TO OBTAIN WARRANTY COVERAGE

The customer must provide Mercury with a reasonable opportunity to repair, and reasonable access to the product for warranty service. Warranty claims shall be made by delivering the product for inspection to a Mercury dealer authorized to service the product. If purchaser cannot deliver the product to such a dealer, written notice must be given to Mercury. We will then arrange for the inspection and any covered repair. Purchaser in that case shall pay for all related transportation charges and/or travel time. If the service provided is not covered by this warranty, purchaser shall pay for all related labor and material, and any other expenses associated with that service. Purchaser shall not, unless requested by Mercury, ship the product or parts of the product directly to Mercury. The warranty registration card is the only valid registration identification and must be presented to the dealer at the time warranty service is requested in order to obtain coverage.

WHAT IS NOT COVERED

This limited warranty does not cover electrical system corrosion; corrosion resulting from damage, corrosion which causes purely cosmetic damage, abuse or improper service; corrosion to accessories, instruments, steering systems; corrosion to factory installed jet drive unit; damage due to marine growth; product sold with less than a one year limited Product warranty; replacement parts (parts purchased by the Customer); products used in a commercial application. Commercial use is defined as any work or employment related use of the product, or any use of the product which generates income, for any part of warranty period, even if the product is only occasionally used for such purposes.

CA459

Transferable Warranty

The product warranty is transferable to a subsequent purchaser, but only for the remainder of the unused portion of the limited warranty. This will not apply to products used for commercial applications.

Direct Sale By Owner

- The second owner can be registered as the new owner and retain the unused portion of the limited warranty by sending the former owner's plastic Owner Warranty Registration Card and a copy of the bill of sale to show proof of ownership. In the United States and Canada, mail to:

Mercury Marine
Attn: Warranty Registration Department
W6250 West Pioneer Road
P.O. Box 1939
Fond du Lac, WI 54936-1939

- A new Owner Warranty Registration Card will be issued with the new owner's name and address. Registration records will be changed on the factory computer registration file.
- There is no charge for this service.

Outside the United States and Canada, please contact the distributor in your country, or the Marine Power International Service Center closest to you, for the transferable warranty procedure that would apply to you.

CA862

Mercury Product Protection Plan

United States And Canada Only

(Certain performance products, triple engine installations, and commercial applications are excluded)

The Mercury Product Protection Plan provides coverage against unexpected mechanical and electrical breakdowns that may occur beyond the standard limited warranty.

The optional Mercury Product Protection Plan is the only Factory Plan available for your engine.

Two, three or four - year term plans can be purchased up to 12 months after the original engine registration date.

See your participating Mercury MerCruiser dealer for complete program details.

Read This Manual Thoroughly

IF YOU DON'T UNDERSTAND ANY PORTION, CONTACT YOUR DEALER FOR A DEMONSTRATION OF ACTUAL STARTING AND OPERATING PROCEDURES.

NOTICE

Throughout this publication, and on your power package, **WARNINGS** and **CAUTIONS**, accompanied by the International Hazard Symbol ▲ , may be used to alert the installer/user to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. **Observe them carefully.**

These "Safety Alerts" alone cannot eliminate the hazards that they signal. Strict compliance with these special instructions while performing the service, plus "common sense" operation, are major accident prevention measures.

⚠ WARNING

WARNING-Hazards or unsafe practices which could result in severe personal injury or death.

⚠ CAUTION

CAUTION-Hazards or unsafe practices which could result in minor personal injury or product or property damage.

IMPORTANT: - Indicates information or instructions that are necessary for proper operation and/or maintenance.

⚠ WARNING

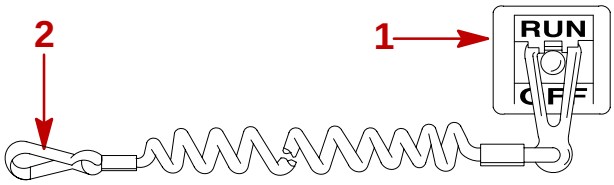
The operator (driver) is responsible for the correct and safe operation of the boat, the equipment aboard and the safety of all occupants aboard. We strongly recommend that the operator read this Operation, Maintenance and Warranty Manual and thoroughly understand the operational instructions for the power package and all related accessories before the boat is used.

CC942

General Information

CB839

Lanyard Stop Switch



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The purpose of a lanyard stop switch (1) is to turn off the engine when the operator moves far enough away from the operator's position (as in accidental ejection from the operator's position) to activate the switch. Some remote control units are equipped with a lanyard stop switch. A lanyard stop switch can be installed on the dashboard or side adjacent to the operator's position.

The lanyard is a cord usually between 4 and 5 ft (1.22 and 1.52 m) in length when stretched out with an element on one end made to be inserted into the switch and a snap (2) on the other end for attaching to the operator. The lanyard is coiled to make its at-rest condition as short as possible so as to minimize the likelihood of lanyard entanglement with nearby objects. It is made as long as it is in its stretched condition to minimize the likelihood of accidental activation should the operator choose to move around in an area close to the normal operator's position. If it is desired to have a shorter lanyard, wrap the lanyard around the operator's wrist or leg, or tie a knot in the lanyard.

IMPORTANT: The purpose of a lanyard stop switch is to stop the engine when the operator moves far enough away from the operator's position to activate the switch. This would occur if the operator accidentally falls overboard or moves within the boat a sufficient distance from the operator's position. Accidental ejections and falls overboard are more likely to occur in certain types of boats such as low sided sport boats or bass boats, and high-performance boats. Accidental ejections and falls overboard are also likely to occur as a result of poor operating practices such as sitting on the back of the seat or gunwale at planing speeds, standing at planing speeds, sitting on elevated fishing boat decks, operating at planing speeds in shallow or obstacle-infested waters, releasing your grip on a steering wheel that is pulling in one direction, drinking alcohol or consuming drugs, or daring, high-speed boat maneuvers.

While activation of the lanyard stop switch will stop the engine immediately, a boat will continue to coast for some distance depending upon the velocity and degree of any turn at shut-down. However, the boat will not complete a full circle. While the boat is coasting, it can cause injury to anyone in the boat's path as seriously as the boat would when under power.

We strongly recommend that other occupants be instructed on proper starting and operating procedures should they be required to operate the engine in an emergency (e.g. if the operator is accidentally ejected).

⚠ WARNING

Should the operator fall out of the boat, the possibility of serious injury or death from being run over by the boat can be greatly reduced by stopping the engine immediately. Always properly connect both ends of the stop switch lanyard to the stop switch and the operator.

Accidental or unintended activation of the switch during normal operation is also a possibility. This could cause any, or all, of the following potentially hazardous situations:

1. Occupants could be thrown forward due to unexpected loss of forward motion - a particular concern for passengers in the front of the boat who could be ejected over the bow and possibly struck by the gear case or propeller.
2. Loss of power and directional control in heavy seas, strong current or high winds.
3. Loss of control when docking.

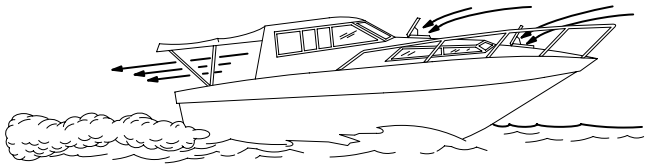
⚠ WARNING

Avoid serious injury or death from deceleration forces resulting from accidental or unintended stop switch activation. The boat operator should never leave the operator's station without first disconnecting the stop switch lanyard from the operator.

CA766

Exhaust Emissions

CA641



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Courtesy of ABYC

CA767

Be Alert To Carbon Monoxide Poisoning

Carbon monoxide is present in the exhaust fumes of all internal combustion engines including the outboards, sterndrives and inboard engines that propel boats, as well as the generators that power various boat accessories. Carbon monoxide is a deadly gas that is odorless, colorless and tasteless.

Early symptoms of carbon monoxide poisoning, which should not be confused with seasickness or intoxication, include headache, dizziness, drowsiness, and nausea.

⚠ WARNING

Avoid the combination of a running engine and poor ventilation. Prolonged exposure to carbon monoxide in sufficient concentration can lead to unconsciousness, brain damage or death.

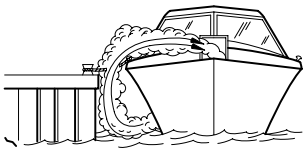
GOOD VENTILATION

Ventilate passenger area, open side curtains, or forward hatches to remove fumes.

1 Example of desired air flow through the boat.

CA643

POOR VENTILATION



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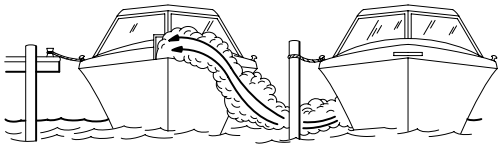


2B

3A

3B

Courtesy of ABYC

Under certain running and/or wind conditions, permanently enclosed or canvas enclosed cabins or cockpits with insufficient ventilation may draw in carbon monoxide. Install one or more carbon monoxide detectors in your boat.

Although the occurrence is rare, on a very calm day, swimmers and passengers in an unclosed area of a stationary boat that contains or is near a running engine may be exposed to a hazardous level of carbon monoxide.

2 Examples of poor ventilation while boat is stationary:

A Running the engine when the boat is moored in a confined space.

B Mooring close to another boat that has its engine running.

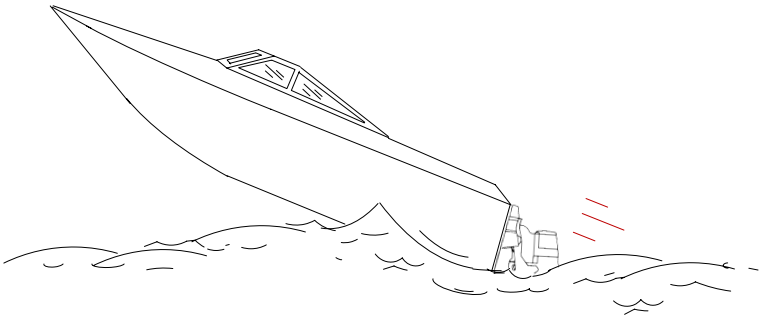
3 Examples of poor ventilation while boat is moving:

A Running the boat with the trim angle of the bow too high.

B Running the boat with no forward hatches open (station wagon effect).

CD543

Wave And Wake Jumping



Operating recreational boats over waves and wakes is a natural part of boating. However, when this activity is done with speed to force the boat hull partially or completely out of the water, certain hazards arise, particularly when the boat re-enters the water.

The primary concern is the boat changing direction while in the midst of the jump. In such case the landing may cause the boat to violently veer in a new direction. Such a sharp change in direction or turn can cause occupants to be thrown out of their seats or out of the boat.

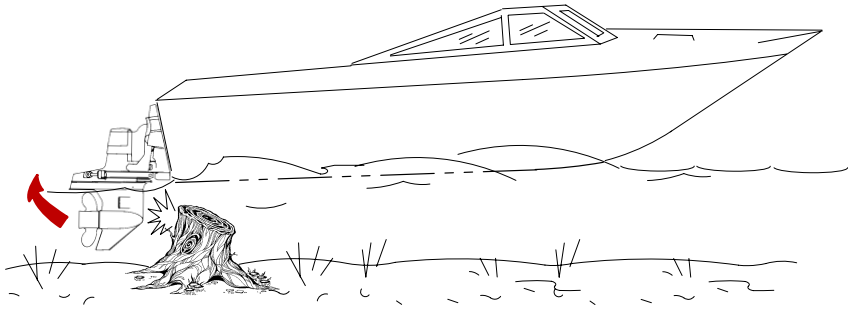
There is another less common hazardous result from allowing your boat to launch off a wave or wake. If the bow of your boat pitches down far enough while airborne, upon water contact it may penetrate under the water surface and “submarine” for an instant. This will bring the boat nearly to a stop in an instant and can send the occupants flying forward. The boat may also steer sharply to one side.

⚠ WARNING

Avoid serious injury or death from being thrown within or out of a boat when it lands after jumping a wave or wake. Avoid wave or wake jumping whenever possible. Instruct all occupants that if a wake or wave jump occurs, get low and hang on to any boat hand hold.

CD604

Impact With Underwater Hazards



Reduce speed and proceed with caution whenever you're driving a boat in shallow water areas or in areas where the waters are suspected of having underwater obstacles that could be struck by the sterndrive or the boat bottom. **The most important thing you can do to help reduce injury or impact damage from striking a floating or underwater object is control the boat speed. Under these conditions, boat speed should be kept to a minimum planing speed of 15 to 25 mph (24 to 40 km/h).**

Striking a floating/underwater object may result in an infinite number of situations. Some of these situations could result in the following:

- The boat could move suddenly in a new direction. Such a sharp change in direction or turn can cause occupants to be thrown out of their seats or out of the boat.
- A rapid reduction in speed. This will cause occupants to be thrown forward, even out of the boat.
- Impact damage to the sterndrive and/or boat.

Keep in mind, one of the most important things you can do to help reduce injury or impact damage in these situations is control the boat speed. Boat speed should be kept to a minimum planing speed when driving in waters known to have underwater obstacles.

After striking a submerged object, stop engine as soon as possible and inspect the sterndrive unit for any broken or loose parts. If damage is present or suspected, the power package should be taken to an authorized dealer for a thorough inspection and necessary repair.

The boat should also be checked for any hull fractures, transom fractures, water leaks.

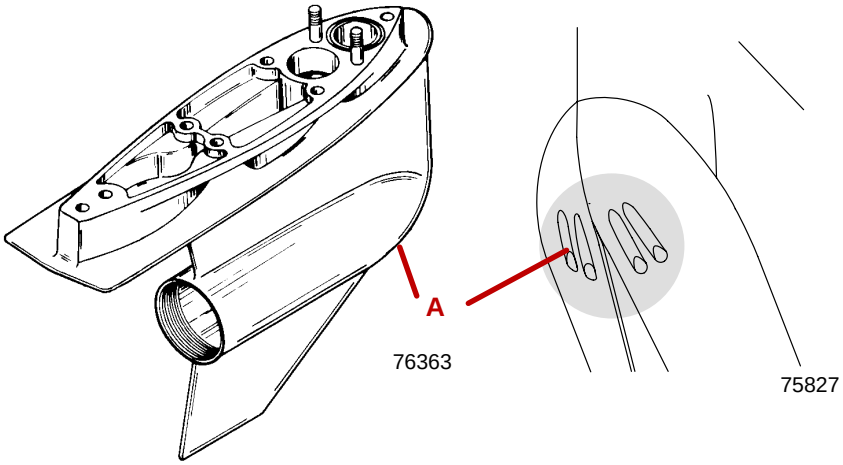
Operating a damaged sterndrive could cause additional damage to other parts of the power package, or could affect control of the boat. If continued running is necessary, do so at greatly reduced speeds.

⚠ WARNING

Avoid serious injury or death from loss of boat control. Continued boating with major impact damage can result in sudden component failure with or without subsequent impacts. Have the power package thoroughly inspected and any necessary repairs made.

CA802

Operating With Low Water Inlets In Shallow Water



⚠CAUTION

Serious engine damage could occur by failing to follow these instructions. Sand, silt or mud could be sucked into the water inlets restricting or shutting off the water supply to the engine.

Extreme care should be exercised when operating a boat equipped with low water inlets (**A**) while maneuvering in shallow water. Also, avoid beaching the boat with the engine(s) running.

CA866

Drive Unit Impact Protection

The Power Trim hydraulic system is designed to provide impact protection for drive unit. If a submerged object is struck while boat is moving forward, the hydraulic system will cushion the kickup of drive unit as it clears the object, reducing damage to unit. After drive unit has cleared object, the hydraulic system allows drive unit to return to original operating position, preventing loss of steering control and engine overspeed.

Use extreme caution when operating in shallow water or where underwater objects are known to be present. Use extreme care to prevent striking submerged object while operating in REVERSE. No impact protection is provided in REVERSE.

If drive unit should strike a submerged object, stop engine as soon as possible and inspect drive unit for damage. If damage is present or suspected, boat should be taken to an Authorized Mercury MerCruiser Dealer for thorough inspection and necessary repair. Operating a damaged drive unit could cause additional damage to other parts of drive unit, or could affect control of boat. If continued running is necessary, do so at greatly reduced speeds.

IMPORTANT: Impact protection system cannot be designed to ensure total protection from impact damage under all conditions.

Safe Boating Suggestions

In order to safely enjoy the waterways, familiarize yourself with local and other governmental boating regulations and restrictions, and consider the following suggestions.

- **Know and obey all nautical rules and laws of the waterways.** Boat operators should complete a boating safety course. Courses are offered in the U.S.A. by (1) The U.S. Coast Guard Auxiliary, (2) The Power Squadron, (3) The Red Cross and (4) your state or provincial boating law enforcement agency. Inquiries may be made to the Boating Hotline, 1-800-368-5647 or the Boat U.S. Foundation information number 1-800-336-BOAT.

We strongly recommend that all powerboat operators attend one of these courses.

You should also review the NMMA Sources of Waterway Information booklet. It lists regional sources of safety, cruising and local navigation and is available at no charge by writing to:

Sources of Waterway Information
National Marine Manufacturers Association
410 N. Michigan Avenue
Chicago, IL 60611 U.S.A.

- **Perform safety checks and required maintenance.** Follow a regular schedule and ensure that all repairs are properly made.
- **Check safety equipment on board.** Here are suggestions of the types of safety equipment to carry when boating:

1 Approved fire extinguisher(s); paddle or oar.

2 Signal devices: flashlight, rockets or flares, flag and whistle or horn.

3 Spare propeller, thrust hubs and an appropriate wrench.

4 Tools for necessary minor repairs; first aid kit and book.

5 Anchor and extra anchor line; water-proof storage containers.

6 Manual bilge pump and extra drain plugs; compass and map or chart of area.

7 Spare operating equipment; batteries, bulbs, fuses, etc.

8 Transistor radio.

9 Drinking water.

- **Know signs of weather change and avoid foul weather and rough-sea boating.**
- **Tell someone where you are going and when you expect to return.**
- **Passenger boarding.** Stop the engine whenever passengers are boarding, unloading or are near the back (stern) of the boat. Just shifting the drive unit into neutral is not sufficient.

- **Use personal flotation devices.** Federal Law requires that there be a U. S. Coast Guard approved, wearable-type life jacket (personal flotation device), correctly sized and readily accessible for every person on board, plus a throwable cushion or ring. We strongly advise that everyone wear a life jacket at all times while in the boat.
- **Prepare other boat operators.** Instruct at least one person on board in the basics of starting and operating the engine and boat handling in case the driver becomes disabled or falls overboard.
- **Do not overload your boat.** Most boats are rated and certified for maximum load (weight) capacities (refer to your boat capacity plate). Know your boat's operating and loading limitations. Know if your boat will float if full of water. When in doubt, contact your dealer or the boats manufacturer.
- **Make sure everyone in the boat is properly seated.** Don't allow anyone to sit or ride on any part of the boat that was not intended for such use. This includes backs of seats, gunwales, transom, bow, decks, raised fishing seats, any rotating fishing seat; anywhere that sudden unexpected acceleration, sudden stopping, unexpected loss of boat control or sudden boat movement could cause a person to be thrown overboard or into the boat. See that all passengers have a proper seat and are in it before any boat movement.
- **Never be under the influence of alcohol or drugs while boating (it is the law).** They impair your judgment and greatly reduce your ability to react quickly.
- **Know your boating area and avoid hazardous locations.**
- **Be alert.** The operator of the boat is responsible by law to "maintain a proper lookout by sight (and hearing)." The operator must have an unobstructed view particularly to the front. No passengers, load, or fishing seats should block the operators view when operating the boat above idle or planing transition speed. Watch "the other guy," the water and your wake.
- **Never drive your boat directly behind a water skier in case the skier falls.** As an example, your boat traveling at 25 miles per hour (40 km/hr) in 5 seconds will overtake a fallen skier who was 200 feet (61 m) in front of you.
- **Watch fallen skiers.** When using your boat for water skiing or similar activities, always keep a fallen or down skier on the operator's side of the boat while returning to attend the skier. The operator should always have the down skier in sight and never back up to the skier or anyone in the water.
- **Report accidents.** Boat operators are required by law to file a Boating Accident Report with their state boating law enforcement agency when their boat is involved in certain boating accidents. A boating accident must be reported if (1) there is loss of life or probable loss of life, (2) there is personal injury requiring medical treatment beyond first aid, (3) there is damage to boats or other property where the damage value exceeds $500.00 or (4) there is complete loss of the boat. Seek further assistance from local law enforcement.

CA282

Protecting People In The Water

While You Are Cruising

It is very difficult for a person standing or floating in the water to take quick action to avoid a boat heading in his/her direction even at slow speed.

Always slow down and exercise extreme caution any time you are boating in an area where there might be people in the water.

Whenever a boat is moving (coasting) and the drive unit is in neutral position, there is sufficient force by the water on the propeller to cause the propeller to rotate. This neutral propeller rotation can cause serious injury.

While Boat Is Stationary

Shift the drive unit into neutral and shut off the engine before allowing people to swim or be in the water near your boat.

⚠ WARNING

Stop your engine immediately whenever anyone in the water is near your boat. Serious injury to the person in the water is likely if contacted by a rotating propeller, a moving boat, a moving gear case, or any solid device rigidly attached to a moving boat or gear case.

CC828

High-Speed And High-Performance Boat Operation

If your boat is considered a high-speed or high-performance boat with which you are unfamiliar, we recommend that you never operate it at its high speed capability without first requesting an initial orientation and familiarization demonstration ride with your dealer or an operator experienced with your boat. For additional information, obtain a copy of our *Hi-Performance Boat Operation* booklet (Part Number 90-849250--1) from your dealer, distributor or Mercury Marine.

CA958

Conditions Affecting Operation

Weight Distribution (Passengers And Gear) Inside The Boat

Shifting weight to rear (stern):

- Generally increases speed and engine rpm.
- At extremes, can cause boat to porpoise.
- Causes bow to bounce in choppy water.
- Increases danger of following wave splashing into boat when coming off plane.

Shifting weight to front (bow):

- Improves ease of planing.
- Improves rough water ride.
- At extremes, can cause boat to veer back and forth (bow steer).

CA959

Bottom Of Boat

To maintain maximum speed, the boat bottom should be:

- Clean, free of barnacles and marine growth.
- Free of distortion; nearly flat where it contacts the water.
- Straight and smooth, fore and aft.

Marine vegetation may accumulate when boat is docked. This growth must be removed before operation; it may clog water inlets and cause engine to overheat.

CA9

Cavitation

Cavitation occurs when water flow cannot follow the contour of a fast-moving underwater object, such as a gear housing or propeller. Cavitation permits the propeller to speed up, but the boat speed to reduce. Cavitation can seriously erode the surface of the gear housing or propeller. Common causes of cavitation are:

- Weeds or other debris snagged on propeller or gear housing.
- Bent propeller blade or damaged gear housing skeg.
- Raised burrs or sharp edges on propeller or gear housing.

CA10

Ventilation

Ventilation is caused by surface air or exhaust gases which are introduced around the propeller resulting in propeller speedup and a reduction in boat speed. Excessive ventilation is annoying and usually caused by:

- Drive unit trimmed out too far.
- A missing propeller diffuser ring.
- A damaged propeller or gear housing, which allows exhaust gases to escape between propeller and gear housing.
- Drive unit installed too high on transom.

CB822

Propeller Selection

IMPORTANT: Installed propeller must allow engine to run at its specified maximum wide open throttle revolutions per minute (rpm). Use an accurate service tachometer to verify engine operating rpm.

It is the responsibility of the boat manufacturer and/or the selling dealer to equip the power package with the correct propellers. Refer to Specifications for engine WOT and operating rpm range.

IMPORTANT: The engines covered in this manual are equipped with an rpm rev-limiter that is set to an upper (or limited) rpm amount. This limit is slightly above the normal operating range of the engine and is designed to help prevent damage from excessive engine rpm. Once the rpm drops into the recommended operating rpm range normal engine operation resumes.

Select a propeller that will allow the engine power package to operate at or near the top end of the recommended WOT operating rpm range with a normal load. High rpm, caused by an excessive trim angle, should not be used in determining correct propeller selection.

If full throttle operation is below the recommended range, the propeller must be changed to prevent loss of performance and possible engine damage. On the other hand, operating an engine above the recommended operating rpm range will cause higher than normal wear and/or damage.

After initial propeller selection, the following common problems may require that the propeller be changed to a lower pitch.

- Warmer weather and greater humidity cause a loss of rpm.
- Operating in a higher elevation causes a loss of rpm.
- Operating with a damaged propeller or dirty boat bottom causes a loss of rpm.
- Operating with increased load (additional passengers, pulling skiers) causes a loss or rpm.

For better acceleration, such as is needed for water skiing, use the next lower pitch propeller. Do not operate at full throttle when using the lower pitch propeller but not pulling skiers.

CA960

How Elevation And Climate Affect Performance

Elevation has a very noticeable effect on the wide open throttle power of an engine. Since air gets thinner as elevation increases, the engine begins to starve for air. Humidity, barometric pressure and temperature do have a noticeable effect on the density of air. Heat and humidity thin the air. This condition can become particularly annoying when the propeller testing was done on a cool, dry day. Then later; on a hot, sultry day, the boat doesn't seem to have the same performance.

Although some performance can be regained by dropping to a lower pitch propeller, the basic problem still exists. In some cases, a gear ratio change to more reduction is possible and very beneficial.

Summer conditions of high temperature, low barometric pressure and high humidity all combine to reduce the engine power. This, in turn, is reflected in decreased boat speeds, as much as 2 or 3 mph (3 - 5 km/hr) in some cases. Nothing will regain this speed for the boater, but the coming of cool, dry weather.

In pointing out the practical consequences of weather effects, an engine running on a hot, humid, summer day, may encounter a loss of as much as 14% of the horsepower it would produce on a dry, brisk spring or fall day. With the drop in available horsepower, this propeller will, in effect, become too large. Consequently, the engine operates at less than its recommended rpm. This will result in further loss of horsepower at the propeller with another decrease in boat speed. This secondary loss, however, can be somewhat regained by switching to a lower-pitch propeller that allows the engine to again run at recommended rpm.

For boaters to realize optimum engine performance under changing weather conditions, it is essential that the engine be propped to allow it to operate at or near the top end of the recommended maximum rpm range at WOT with a normal boat load.

Not only does this allow the engine to develop full power, but equally important is the fact that the engine also will be operating in an rpm range that discourages detonation. This, of course, enhances overall reliability and durability of the engine.

CA863

Important Information

Operation And Maintenance

OWNER/OPERATOR RESPONSIBILITIES

It is the operator's responsibility to perform all safety checks; to ensure that all lubrication and maintenance instructions are complied with for safe operation and to return the unit to an Authorized Mercury MerCruiser Dealer for a periodic checkup.

Normal maintenance service and replacement parts are the responsibility of the owner/operator and as such, are not considered defects in workmanship or material within the terms of the warranty. Individual operating habits and usage contribute to the need for maintenance service.

Proper maintenance and care of your power package will assure optimum performance and dependability, and will keep your overall operating expenses at a minimum. See your Authorized Mercury MerCruiser Dealer for service aids.

CA864

DEALER RESPONSIBILITIES

In general, a dealer's responsibilities to the customer include predelivery inspection and preparation such as:

- Make sure that the boat is properly equipped.
- Prior to delivery, make certain that the Mercury MerCruiser power package and other equipment are in proper operating condition.
- Make all necessary adjustments for maximum efficiency.
- Familiarize the customer with the on-board equipment.
- Explain and demonstrate the operation of the power package and boat.
- At the time of delivery, the dealer should provide you with a copy of a Predelivery Inspection Checklist.
- Your selling dealer should fill out the Warranty Registration Card completely and mail it to the factory immediately upon sale of the new product.

CA865

Freezing Temperature Operation

IMPORTANT: If boat is operated during periods of freezing temperature, precautions must be taken to prevent freezing damage to power package. Damage caused by freezing IS NOT covered by Mercury MerCruiser Limited Warranty.

CA867

Drain Plug and Bilge Pump

The engine compartment in your boat is a natural place for water to collect. For this reason, boats are normally equipped with a drain plug and/or a bilge pump. It is very important to check these items on a regular basis to ensure that the water level does not rise to come in contact with your power package. Components on your engine will be damaged if submerged. Damage caused by submersion is not covered by the Mercury MerCruiser Limited Warranty.

CA869

Attention Required After Submersion

- Before recovery, contact an Authorized Mercury MerCruiser Dealer.
- After recovery, immediate service by an Authorized Mercury MerCruiser Dealer is required to prevent serious damage to power package.

CA870

Trailering Boat

Boat can be trailered with drive unit in UP or DOWN position. Adequate road clearance is required between road and gear housing skeg when trailering with drive unit in DOWN position.

If adequate road clearance is a problem, place drive unit in full trailer position and support with an optional trailer kit which is available from your Authorized Mercury MerCruiser Dealer.

CA20

Launching And Boat Operation Care

⚠ CAUTION

During launching from a trailer, if the unloading ramp is steep or the trailer bed must be tilted, the boat may enter the water rapidly and at a steep angle. This may force water through the exhaust system into the cylinders. The more weight on the transom, the more likely this is to occur.

Slowing down rapidly or stopping suddenly may cause a following wave to “swamp” the transom. In this instance, water may enter the cylinders through the exhaust system.

When backing up rapidly, the same situation may occur as stated in the preceding paragraph.

In any of these situations, water entering the engine could cause severe damage to internal parts. Refer to Attention Required After Submersion.

CA21

Stolen Power Package

If your power package is stolen, immediately advise the local authorities and Mercury Marine of the model and serial numbers and to whom the recovery is to be reported. This “Stolen Motor” information is placed into a file at Mercury Marine to aid authorities and dealers in recovery of stolen motors.

CA871

Replacement Service Parts

⚠ WARNING

Electrical, ignition and fuel system components on Mercury MerCruiser gasoline power packages are designed and manufactured to comply with U.S. Coast Guard rules and regulations to minimize risks of fire or explosion.

Use of replacement electrical, ignition or fuel system components, which do not comply to these rules and regulations, could result in a fire or explosion hazard and should be avoided.

When servicing the electrical, ignition and fuel systems, it is extremely important that all components are properly installed and tightened. If not, any electrical or ignition component would permit sparks to ignite fuel vapors from fuel system leaks, if they existed.

Marine engines are expected to operate at or near full-throttle for most of their life. They are also expected to operate in both fresh and saltwater environments. These conditions require numerous special parts. Care should be exercised when replacing marine engine parts as specifications are quite different from those of the standard automotive engine.

For example, one of the most important, and probably the least suspected special replacement part, is the cylinder head gasket. Since saltwater is highly corrosive, the steel-type automotive head gasket cannot be used. A marine engine head gasket uses special materials to resist corrosive action.

Since marine engines must be capable of running at or near maximum rpm much of the time, special valve springs, valve lifters, pistons, bearings, camshafts and other heavy-duty moving parts are required for long life and peak performance.

These are but a few of the many special modifications that are required in Mercury MerCruiser marine engines to provide long life and dependable performance.

CA872

Do-It-Yourself Maintenance Suggestions

If you are one of those persons who likes to do-it-yourself, here are some suggestions for you.

- Present-day marine equipment, such as your Mercury MerCruiser power package, are highly technical pieces of machinery. Electronic ignition and special fuel delivery systems provide greater fuel economies, but also are more complex for the untrained mechanic.
- Do not attempt any repairs which are not covered in this manual unless you are aware of the precautions (Cautions and Warnings) and procedures required. Your safety is of our concern.
- If you attempt to service the product yourself, we suggest you order the service manual for that model. The service manual outlines the correct procedures to follow. It is written for the trained mechanic, so there may be procedures you don’t understand. Do not attempt repairs if you do not understand the procedures.
- There are special tools and equipment that are required to perform some repairs. Do not attempt these repairs unless you have these special tools and/or equipment. You can cause damage to the product in excess of the cost a dealer would charge you.

- Also, if you partially disassemble an engine or drive assembly and are unable to repair it, the dealer's mechanic must reassemble the components and test to determine the problem. This will cost you more than taking it to the dealer immediately upon having a problem. It may be a very simple adjustment to correct the problem.
- Do not telephone the dealer, service office or the factory to attempt for them to diagnose a problem or request the repair procedure. It is difficult for them to diagnose a problem over the telephone.
- Your Authorized Dealer is there to service your power package. They have qualified factory-trained mechanics.

It is recommended you have the dealer do periodic maintenance checks on your power package. Have them winterize it in the fall and service it before the boating season. This will reduce the possibility of any problems occurring during your boating season when you want trouble-free boating pleasure.

CB840

NOTE: *All references to EFI models apply to MPI engines.*

CB841

NOTE: *All references to ECM apply to all engine control modules including the propulsion control module (PCM).*

CA782

Multiple EFI Engine Battery Precautions

Situation

Alternators: Alternators are designed to charge the battery that supplies electrical power to the engine that the alternator is mounted on. When batteries for two different engines are connected, one alternator will supply all of the charging current for both batteries. Normally, the other engine's alternator will not be required to supply any charging current.

EFI Electronic Control Module (ECM): The ECM requires a stable voltage source. During multiple engine operation, an onboard electrical device may cause a sudden drain of voltage at the engine's battery. The voltage may go below the ECM's minimum required voltage. Also, the alternator on the other engine may now start charging. This could cause a voltage spike in the engine's electrical system.

In either case, the ECM could shut off. When the voltage returns to the range that the ECM requires, the ECM will reset itself. The engine will now run normally. This ECM shut down usually happens so fast that the engine just appears to have an ignition miss.

Recommendations

Batteries: Boats with multi-engine EFI power packages require each engine be connected to its own battery. This ensures that the engine's Electronic Control Module (ECM) has a stable voltage source.

Battery Switches: Battery switches should always be positioned so each engine is running off its own battery. DO NOT operate engines with switches in **BOTH** or **ALL** position. In an emergency, another engine's battery can be used to start an engine with a dead battery.

Battery Isolators: Isolators can be used to charge an auxiliary battery used for powering accessories in the boat. They should not be used to charge the battery of another engine in the boat unless the type of isolator is specifically designed for this purpose.

Generators: The generator's battery should be considered another engine's battery.

CC1038

Diagnosing EFI Problems

Your Authorized Mercury MerCruiser Dealer has the proper service tools for diagnosing problems on Electronic Fuel Injection (EFI) Systems. The Electronic Control Module (ECM) on these engines has the ability to detect some problems with the system when they occur, and store this information in the ECM's memory. This data can then be read later by a service technician using a special diagnostic tool.

CA413

20-Hour Break-In Period

IMPORTANT: The first 20 hours of operation is the engine break-in period. Correct break-in is essential to obtain minimum oil consumption and maximum engine performance. During this break-in period, the following rules must be observed:

- Do not operate below 1500 rpm for extended periods of time for first 10 hours. Shift into gear as soon as possible after starting and advance throttle above 1500 rpm **if conditions permit safe operation.**
- Do not operate at one speed consistently for extended periods.
- Do not exceed 3/4 throttle during first 10 hours. During next 10 hours, occasional operation at full throttle is permissible (5 minutes at a time maximum).
- Avoid full throttle acceleration from IDLE speed.
- Do not operate at full throttle until engine reaches normal operating temperature.
- Frequently check crankcase oil level. Add oil if needed. It is normal for oil consumption to be high during break-in period.

CA874

After Break-In Period

To help extend the life of your Mercury MerCruiser power package, the following recommendations should be considered;

- Use a propeller that allows the engine to operate at or near the top of the maximum rpm range (See Specifications section) when at full throttle with a normal boat load.
- Operation at 3/4 throttle setting or lower is recommended. Refrain from prolonged operation at maximum (full throttle) rpm.

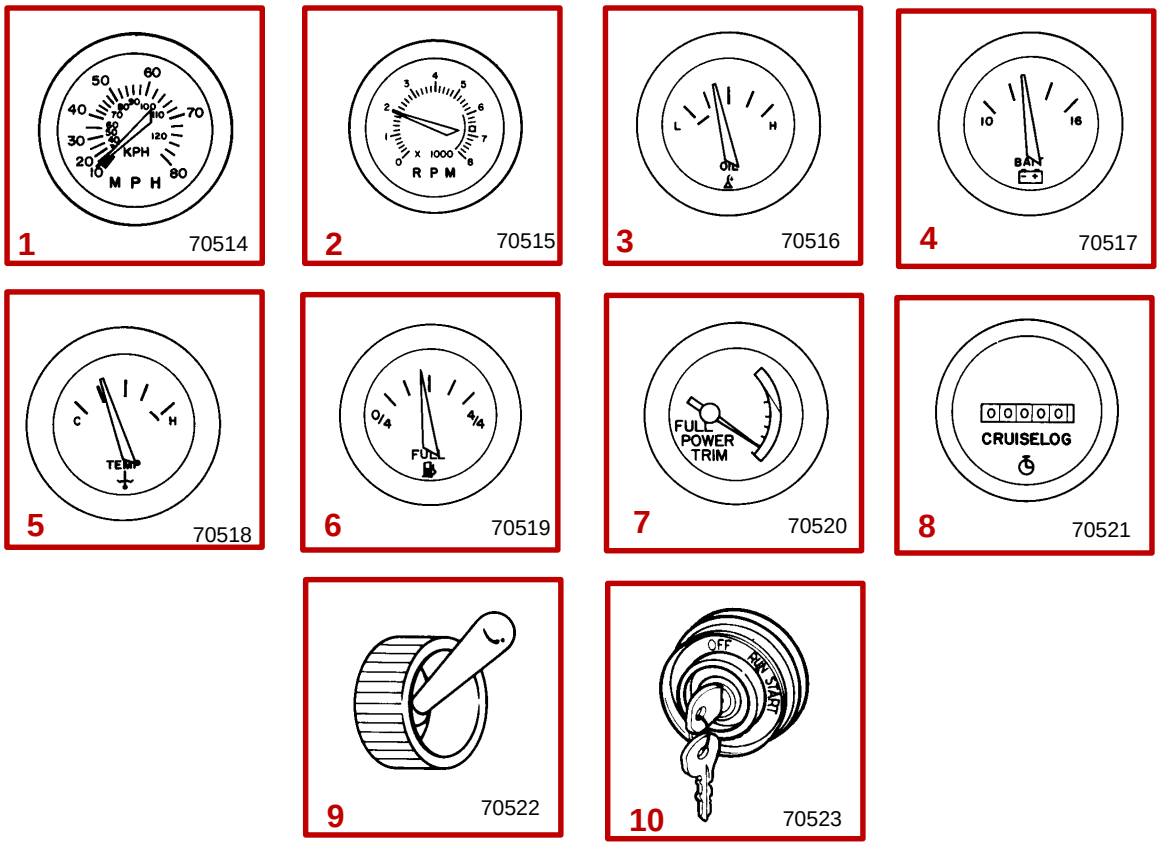
CA875

End of First Season Checkup

At the end of the first season of operation, an Authorized Mercury MerCruiser Dealer should be contacted to discuss and/or perform various scheduled maintenance items. If you are in an area where the product is operated continuously (year-round operation), you should contact your dealer at the end of the first 100 hours of operation, or once yearly, whichever occurs first.

Operation

Instrumentation



The following is a brief explanation of instrumentation typically found on some boats. The owner/operator should be familiar with all instruments and their functions on the boat. Because of the large variety of instrumentation and manufacturers, you should have your boat dealer explain the particular gauges and normal readings that will appear on your style gauges.

1 **Speedometer**: Indicates boat speed.

2 **Tachometer**: Indicates engine rpm.

3 **Oil Pressure Gauge**: Indicates engine oil pressure.

4 **Battery Meter**: Indicates battery voltage.

5 **Water Temperature Gauge**: Indicates engine operating temperature.

6 **Fuel Gauge**: Indicates quantity of fuel in tank.

7 **Power Trim Gauge**: Indicates drive unit angle (trim UP/OUT and DOWN/IN).

8 **Hour Meter**: Records engine running time.

9 **Bilge Blower Switch**: Operates bilge blower (If equipped - see Starting, Shifting and Stopping procedure).

10 **Ignition Switch**: Allows operator to start and stop engine.

CB837

SMARTCRAFT PRODUCT

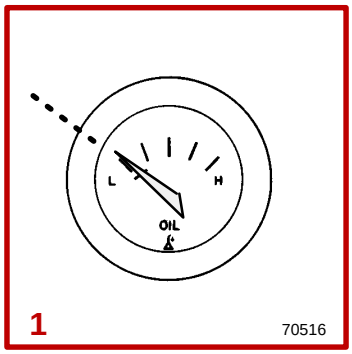
A Mercury SmartCraft System instrument package can be purchased for this product. A few of the functions the instrument package will display are engine rpm, coolant temperature, water pressure, battery voltage, fuel consumption and engine operating hours.

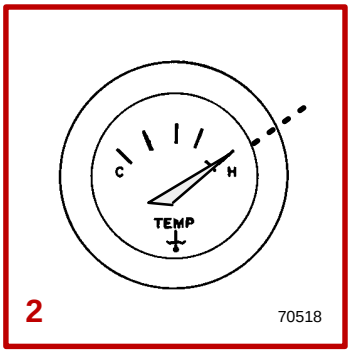
The SmartCraft Instrument package will also aid in Engine Guardian diagnostics. The SmartCraft Instrument package will display critical engine alarm data and potential problems.

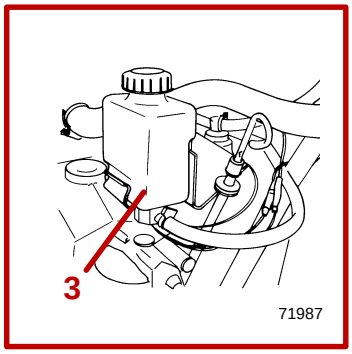
Refer to the ***Mercury SmartCraft Operator's Supplement*** (90-10229021) for the warning functions monitored and basic operation of the SmartCraft Instrument package.

CB842

Audio Warning System







Your Mercury MerCruiser power package may be equipped with an Audio Warning System.

The audio warning system alarm will sound if one of the following occur:

1 Engine Oil Pressure Too Low

2 Engine Temperature Too Hot

3 Drive Oil Level Too Low

4 Engine Guardian Activated (Refer to Engine Guardian.)

NOTE: *To test the system: Turn the ignition switch to the ON position without cranking the engine. The alarm will sound if the system is working correctly.*

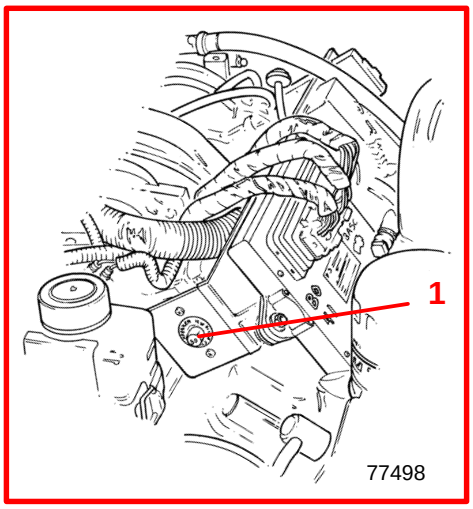
⚠CAUTION

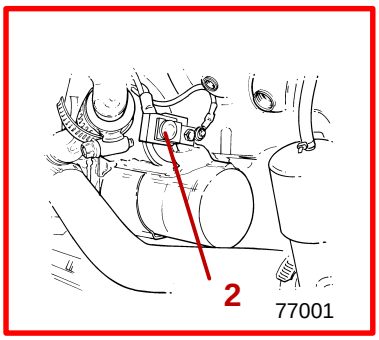
Avoid engine damage. Do not operate engine once the alarm has sounded EXCEPT TO AVOID A HAZARDOUS SITUATION. The Audio Warning System will not protect the engine from damage. It is designed to warn the operator that a problem has occurred.

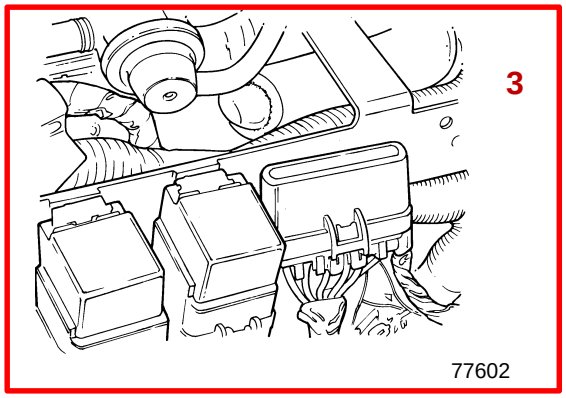
When the alarm sounds with the engine running, stop engine immediately. Investigate cause and correct it, if possible. If cause cannot be determined, consult your Authorized Mercury MerCruiser Dealer.

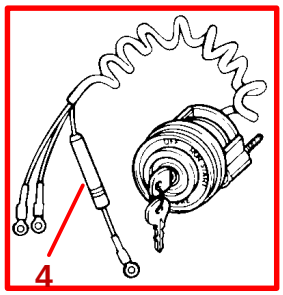
CC1039

Electrical System Overload Protection









If an electrical overload occurs, a fuse will blow or the circuit breaker will trip open. The cause must be found and corrected before replacing fuse or resetting circuit breaker.

1 A circuit breaker provides protection for engine wiring harness and instrumentation power lead. Reset by pushing RESET button IN.

NOTE: *In an emergency, when engine must be operated and cause for high current draw cannot be located and corrected, turn OFF or disconnect all accessories connected to engine and instrumentation wiring. Reset circuit breaker. If breaker remains open, electrical overload has not been eliminated. Further checks must be made on electrical system.*

2 A 90 Amp fuse is located on the starter solenoid. This fuse is designed to protect the engine wiring harness if an electrical overload occurs.

3 Three fuses are located on the port side of the engine. These fuses control various EFI circuits.

A Fuel Pump Fuse - 20 Amp

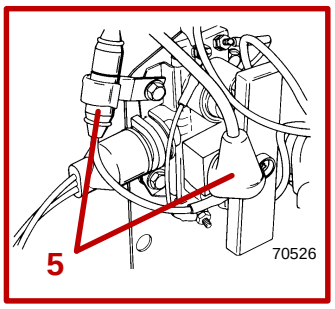
B ECM / Injector Fuse - 20 Amp

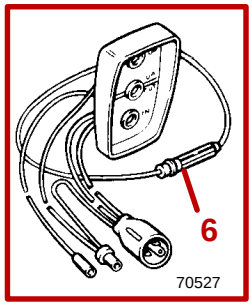
C ECM / Battery Fuse - 20 Amp

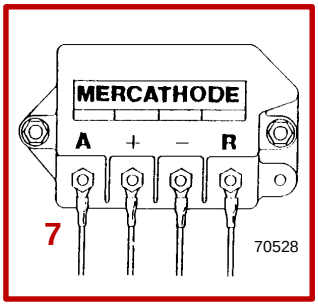
4 A 20 amp fuse may be located in ignition switch “I” terminal lead to protect electrical system. Check for blown fuse if key is turned to START and nothing happens (and circuit breaker is not tripped).

CB827

Electrical System Overload Protection (Continued)







CB833

5 The Power Trim System is protected from overload by 110 amp fuse and a 20 amp in-line fuse on Power Trim pump.

6 Quicksilver Three-Button Power Trim Control Panel is further protected by a 20 amp in-line fuse.

7 The Quicksilver MerCathode System has a 20 amp in-line fuse in the wire which connects to positive (+) terminal on controller. If fuse is blown, system will not operate and a loss of corrosion protection will result.

CA933

Remote Controls

CC1036

Kiekhaefer Remote Control Features

Consult your dealer for a description and/or demonstration of other remote controls.

1 **Shift Control Handle -** Push the control handle forward from NEUTRAL with a quick firm motion for FORWARD gear. Pull the control handle back from NEUTRAL with a quick firm motion for REVERSE gear.

⚠CAUTION

On Dual Engine Applications: Both shift control handles should be moved simultaneously into the same gear.

A **Dual Engine Shift Control Handles -** Dual engine applications have separate control handles for each engine. The operation of the dual engine control handles is the same as the single engine control handle.

2 **Throttle Control Handle -** Push the control handle forward to increase speed. Pull the control handle back toward the detent to decrease speed. Pulling the control handle past the detent will increase reverse speed.

⚠CAUTION

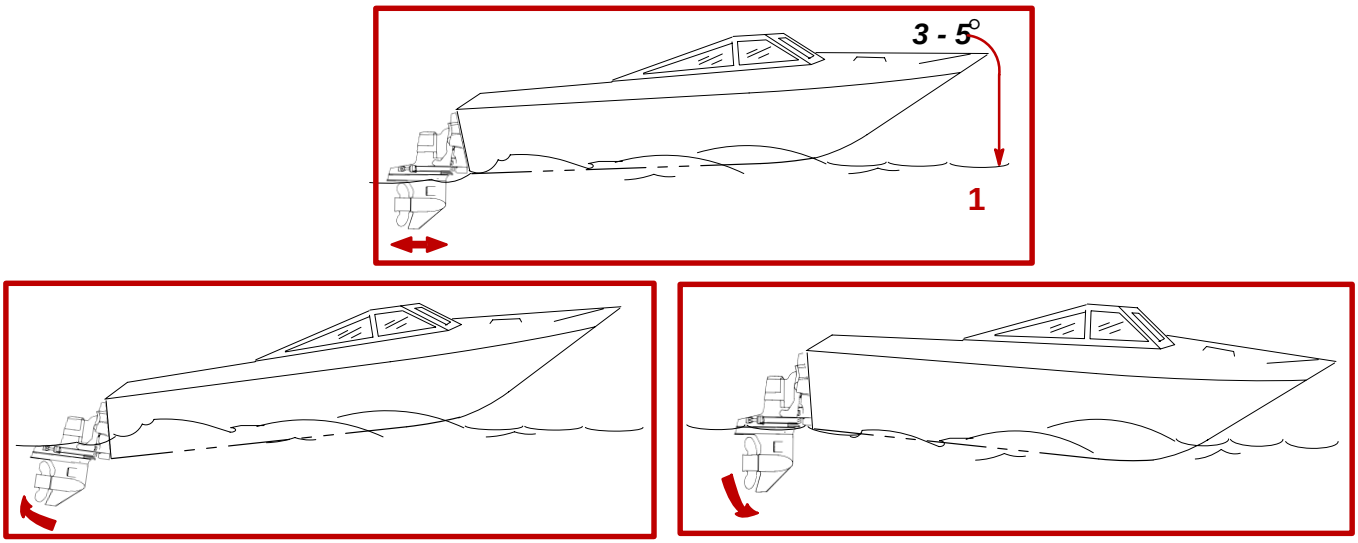
On Dual Engine Applications: Always operate dual engines at similar rpm.

A **Dual Engine Throttle Control Handles -** Dual engine applications have separate control handles for each engine. The operation of the dual engine control handles is the same as the single engine control handle.

3 **Trim Button (If Equipped) -** Refer to Power Trim Operation.

CB817

Power Trim



Power Trim allows the operator to adjust the drive angle, while underway, to provide the ideal boat angle for varying load and water conditions. Also, the Power Trim system Trailering feature allows the operator to raise and lower the drive unit for trailering, beaching, launching and low speed (below 1200 rpm engine speed), shallow water operation.

⚠CAUTION

Use extreme caution when operating with drive unit raised. Severe damage to the drive unit may result if unit is raised beyond the gimbal ring support flanges at engine speeds above 1200 rpm.

1 In most cases, best overall performance is obtained with the drive unit adjusted so the boat bottom will run at a 3° to 5° angle to the water.

Trimming Drive Unit UP/OUT Can:

- Generally increase top speed.
- Increase clearance over submerged objects or a shallow bottom.
- Cause boat to accelerate and plane off slower.
- In excess, cause boat “porpoising” (bouncing) or propeller ventilation.
- Cause engine overheating if trimmed UP/OUT to a point where any cooling water intake holes are above the water line.

Trimming Drive Unit DOWN/IN Can:

- Help the boat accelerate and plane off quicker.
- Generally improve the ride in choppy water.
- In most cases, reduce boat speed.
- If in excess, lower the bow of some boats to a point at which they begin to plow with their bow in the water while on plane. This can result in an unexpected turn in either direction called bow steering or over steering if any turn is attempted, or if a significant wave is encountered.

CB804

SINGLE ENGINE TRIM/TRAILER

Single engine applications will have a button that can be pressed to trim the drive unit up or down.

To raise the drive unit for trailering, beaching, launching and low speed, (below 1200 rpm) shallow water operation push the trim button to raise the drive unit to the full UP / OUT position.

Some controls also have a trailer button that trims the drive to a position suitable only for trailer purposes.

DUAL ENGINE TRIM/TRAILER

⚠ CAUTION

When lowering or raising sterndrives equipped with a dual engine tie bar kit, the sterndrives must be raised or lowered evenly to prevent the tie bar from becoming twisted. Failure to raise or lower sterndrives evenly may result in tie bar or sterndrive damage.

Dual engine applications may have a single integral button to operate both drive units simultaneously or may have separate buttons for each drive unit.

Some controls also have a trailer button that trims the drives to a position suitable for trailer purposes only.

CB797

Starting, Shifting And Stopping

⚠ WARNING

Before starting engine, operate bilge blower for at least five minutes to remove any explosive fumes from engine compartment. If boat is not equipped with a bilge blower, open engine hatch and leave open while starting engine.

⚠ CAUTION

It is good practice to ventilate the engine compartment prior to servicing any engine components to remove any fuel vapors which may cause difficulty breathing or be an irritant.

IMPORTANT: Observe the following:

- **Do not start engine without water being supplied to seawater pickup pump (to prevent pump or engine damage).**
- **Do not operate starter motor continuously for more than 30 seconds.**
- **Never shift drive unit unless engine is at idle rpm.**

Perform the following as appropriate:

1 Check all items listed in Operation Chart.

2 Perform any other necessary checks, as indicated by your dealer, or specified in your boat owner's manual.

3 Place drive unit in full DOWN/IN position.

4 Place control handle in NEUTRAL.

5 Position throttle setting as follows:

A **COLD ENGINE** - Leave in NEUTRAL/IDLE speed position.

B **WARM ENGINE** - Leave in NEUTRAL/IDLE speed position.

C **FLOODED ENGINE** - Turn ignition switch to ON position. Push the throttle only button and place the throttle lever in the 50% position. Attempt to start engine. As soon as engine starts, return throttle to the IDLE position.

6 Turn ignition key to the START position. Release key when engine starts and allow switch to return to RUN position.

7 Check oil pressure gauge immediately after engine starts. If oil pressure is not within specified range (Refer to Specifications), stop engine immediately and determine cause.

8 If engine is cold, operate engine for 1 or 2 minutes at fast idle (1000-1500 rpm).

9 After engine has warmed up, check water temperature gauge to ensure that engine temperature is not abnormally high. If it is, stop engine immediately and determine cause.

10 Be sure charging system is functioning correctly.

11 Observe power package for fuel, oil, water and exhaust leaks.

12 To shift drive unit, return control/throttle lever to NEUTRAL. Move control/shift lever with a firm, quick motion forward to shift into FORWARD gear, or backward to shift into REVERSE. After shifting drive unit, advance throttle to desired setting.

13 Move control/shift lever to NEUTRAL and allow engine to drop to IDLE speed. If engine has been operated at high speed for a long period of time, allow engine to cool by operating at IDLE speed for 3 to 5 minutes.

14 Turn ignition key to OFF.

CC829

⚠CAUTION

To avoid possible ingestion of water that can damage engine components:

- **Do not turn the ignition key off when the engine is running above idle speed.**
- **Do not use the lanyard stop switch to shut off the engine above idle speed.**
- **When coming off plane, if a large following wave may roll over the boat's transom, apply a short, light burst of throttle to minimize the wave action against the stern of the boat.**
- **Do not come off plane quickly, shift into reverse and shut off engine.**

CB575

IMPORTANT: Avoid stopping engine if the drive unit is in gear. If engine does stop with drive unit in gear, refer to the following procedure:

15 Push and pull repeatedly on remote control handle until handle returns to the neutral detent position. This may take several tries if the power package was operating above idle rpm when the engine stopped.

16 After handle returns to the neutral detent position, resume normal starting procedures.

CB843

Engine Guardian

IMPORTANT: Boat speed could be reduced to idle and may not respond to throttle.

Engine Guardian Strategy is designed to help reduce the potential for engine damage by reducing engine power when a potential problem is sensed. Engine Guardian monitors:

- Oil Pressure
- Coolant Temperature
- Sea Pump Pressure
- Exhaust Manifold Temperature

For example, if one exhaust manifold's water cooling passages become partially blocked, Engine Guardian will reduce the power level of the engine to bring the temperature on that manifold back into the normal operating temperature range. If the debris passes through and full water flow is restored, engine power levels are restored back to normal. In other words, Engine Guardian is a looped feedback or smart system.

CB826

Operation Chart

BEFORE STARTING	AFTER STARTING	WHILE UNDERWAY	AFTER STOPPING
Open engine hatch.	Observe all gauges to check condition of engine. If not normal, stop engine.	Observe all gauges to check condition of engine. If not normal, stop engine.	Turn ignition key to OFF.
Turn battery switch ON, if equipped.	Check for fuel, oil, water, fluid and exhaust leaks.	Listen for audio warning horn signifying Guardian Mode.	Turn battery switch OFF, if equipped.
Operate bilge blowers, if equipped.	Check shift and throttle control operation.		Close fuel shutoff valve.
Open fuel shutoff valve.	Check steering operation.		Close seacock, if equipped.
Open seacock, if equipped.			Flush cooling system if in saltwater.
Place drive unit in full DOWN/IN position.			Open air actuated drain system if boat is out of water or seacock is closed.
Close air actuated drain system.			
Perform all other checks specified by your dealer and/or boat builder.			
Listen for Audio Warning Alarm to sound when the ignition switch is in the ON position.			

CA964

Specifications

Fuel Recommendations

⚠ CAUTION

Use of improper gasoline can damage your engine seriously. Engine damage resulting from use of improper gasoline is considered misuse of engine, and damage caused thereby will not be covered under the limited warranty.

FUEL RATINGS

Mercury MerCruiser engines will operate satisfactorily when using a major brand of unleaded gasoline as follows:

USA and Canada - having a posted pump Octane Rating of 87 (R+M)/2 minimum. Premium gasoline [92 (R+M)/2 Octane] is also acceptable. DO NOT use leaded gasoline.

Outside USA and Canada - having a posted pump Octane Rating of 90 RON minimum. Premium gasoline (98 RON) is also acceptable. If unleaded gasoline is not available, use a major brand of leaded gasoline.

CA878

USING REFORMULATED (OXYGENATED) GASOLINES (USA ONLY)

This type of gasoline is required in certain areas of the USA. The two types of oxygenates used in these fuels is Alcohol (Ethanol) or Ether (MTBE or ETBE). If Ethanol is the oxygenate that is used in the gasoline in your area, refer to Gasolines Containing Alcohol also.

These Reformulated Gasolines are acceptable for use in your Mercury MerCruiser engine.

CA879

GASOLINES CONTAINING ALCOHOL

If the gasoline in your area contains either methanol (methyl alcohol) or ethanol (ethyl alcohol), you should be aware of certain adverse effects that can occur. These adverse effects are more severe with methanol. Increasing the percentage of alcohol in the fuel can also worsen these adverse effects.

Some of these adverse effects are caused because the alcohol in the gasoline can absorb moisture from the air, resulting in a separation of the water/alcohol from the gasoline in the fuel tank.

The fuel system components on your Mercury MerCruiser engine will withstand up to 10% alcohol content in the gasoline. We do not know what percentage your boat's fuel system will withstand. Contact your boat manufacturer for specific recommendations on the boats fuel system components (fuel tanks, fuel lines, and fittings). Be aware that gasolines containing alcohol may cause increased:

- Corrosion of metal parts.
- Deterioration of rubber or plastic parts.
- Fuel permeation through rubber fuel lines.
- Starting and operating difficulties.

⚠ WARNING

FIRE AND EXPLOSION HAZARD: Fuel leakage from any part of fuel system can be a fire and explosion hazard which can cause serious bodily injury or death. Careful periodic inspection of entire fuel system is mandatory, particularly after storage. All fuel components including fuel tanks, whether plastic metal or fiberglass, fuel lines, fittings, fuel filters and carburetors/fuel injection components should be inspected for leakage, softening, hardening, swelling or corrosion. Any sign of leakage or deterioration requires replacement before further engine operation.

Because of possible adverse effects of alcohol in gasoline, it is recommended that only alcohol-free gasoline be used where possible. If only fuel containing alcohol is available, or if the presence of alcohol is unknown, increased inspection frequency for leaks and abnormalities is required.

IMPORTANT: When operating a Mercury MerCruiser engine on gasoline containing alcohol, storage of gasoline in the fuel tank for long periods should be avoided. Long periods of storage, common to boats, create unique problems. In cars alcohol-blend fuels normally are consumed before they can absorb enough moisture to cause trouble, but boats often sit idle long enough for phase separation to take place. In addition, internal corrosion may take place during storage if alcohol has washed protective oil films from internal components.

CC540

Seacock Size Recommendation

Seacock used must have an internal cross-sectional area equal to or greater than hose to prevent restricting waterflow. Install valve in an area where it will be easily accessible and supported adequately to prevent hose fatigue. A 1-1/4 in. (32 mm) brass ball or gate valve is suggested.

CA693

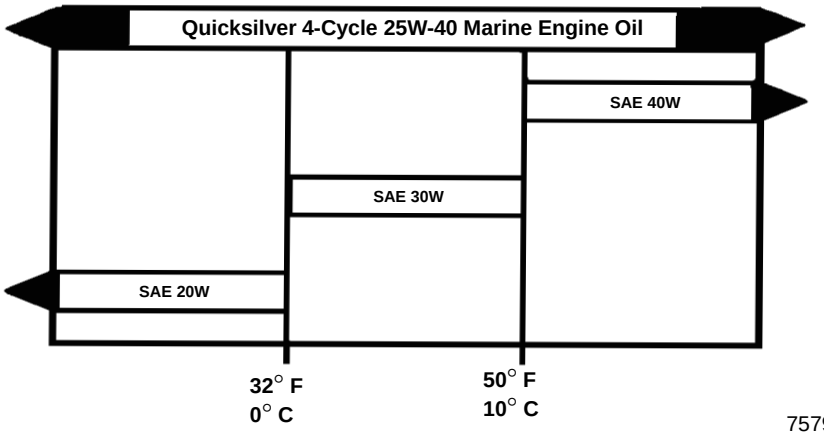
Crankcase Oil

To help obtain optimum engine performance and to provide maximum protection, we strongly recommend the use of Quicksilver 4-Cycle 25W-40 Marine Engine Oil. This oil is a special blend of 25-weight and 40-weight oils for marine engines. If not available, a good grade, straight weight, detergent automotive oil of correct viscosity, with an API classification of SH,CF/CF-2, may be used.

In those areas where Quicksilver 4-Cycle 25W-40 Marine Engine Oil or a recommended straight weight oil are not available, a multi-viscosity 20W-40 or, as a second but less preferable choice, 20W-50, with API service ratings of SH, CF/CF-2 may be used.

IMPORTANT: The use of non-detergent oils, multi-viscosity oils (other than Quicksilver 25W-40 or a good quality 20W-40 or 20W-50), synthetic oils, low quality oils or oils that contain solid additives are specifically not recommended.

The chart below is a guide to crankcase oil selection. The oil filter should always be changed when changing engine oil.



Engine Specifications

Models	496 MAG HO	496 MAG
Propshaft Horsepower	425[1]	375[1]
Propshaft Kilowatts	317[1]	280[1]
Displacement	496 cid (8.1L)	
Maximum rpm @ WOT[2]	4600-5000 rpm	4400-4800 rpm
Idle rpm in NEUTRAL[2]	650 rpm	
Oil Pressure @ 2000 rpm	Minimum 30 psi (207 kPa)	
Oil Pressure @ Idle	Minimum 15 psi (103 kPa)	
Thermostat	160° F (71° C)	
Firing Order	1-8-7-2-6-5-4-3	
Electrical System	12-Volt Negative (–) Ground	
Alternator Rating - Hot Operating Amps	65 Amps	
Alternator Rating - Cold Operating Amps	72 Amps	
Recommended Battery Rating (Minimum)	650 cca / 825 mca / 150 Ah	

[1] Power Rated in Accordance with NMMA (National Marine Manufacturers' Association) rating procedures.

[2] Measured using an accurate service tachometer with engine at normal operating temperature.

CB811

Maintenance

⚠ WARNING

Always disconnect battery cables from battery before working around electrical system components to prevent injury to yourself or damage to electrical system should a wire be accidentally shorted.

IMPORTANT: Refer to MAINTENANCE CHART for complete listing of all scheduled maintenance to be performed. Some listings can be done by owner/operator, while others should be performed by an Authorized Mercury MerCruiser Dealer. Before attempting maintenance or repair procedures not covered in this manual, it is recommended that a Mercury MerCruiser Service Manual be purchased and read thoroughly.

NOTE: *Maintenance points are color coded for ease of identification. See the decal on engine for identification.*

- Blue-Coolant
- Yellow-Engine Oil
- Orange-Fuel

Maintenance Aids

1 Power Steering System - Quicksilver Power Trim and Steering Fluid or Dexron III automatic transmission fluid (ATF).

2 Propeller Shaft - Quicksilver Special Lubricant 101.

3 Sterndrive Unit - Quicksilver High Performance Gear Lube.

4 All Exterior Surfaces - Quicksilver Primer and Spray Paint and Quicksilver Corrosion Guard.

5 Power Trim System - Quicksilver Power Trim and Steering Fluid, or SAE 10W-30 motor oil.

6 Crankcase Oil - Quicksilver 4-Cycle Marine Engine Oil (Refer to Specifications for alternatives and oil recommendations for varying ambient temperatures.)

7 Closed Cooling System Coolant - Extended Life Ethylene Glycol 5/100 Antifreeze/Coolant mixed 50/50 with purified water. If this is not available, use a 50/50 mixture of ethylene glycol antifreeze and tap water. Areas where temperatures generally do not go below 32° F (0° C), rust inhibitor and tap water is acceptable.

CB835

Fluid Capacities

NOTICE
Engine Measurements: U.S. Quarts (Liters)
Sterndrive Measurements: U.S. Fluid Ounces (Milliliters)
All capacities are approximate fluid measures.

Engine Model	496 cid / 8.1L
Crankcase Oil [1] (With Filter)	9 (8.5)
Closed Cooling System	19 (18)

[1] Always use dipstick to determine exact quantity of oil or fluid required.

IMPORTANT: It may be necessary to adjust oil levels depending on installation angle and cooling systems (heat exchanger and fluid lines).

Sterndrive Model	Bravo One	Bravo Two	Bravo Three
Drive Unit Oil Capacity (With Gear Lube Monitor)	88 (2603)	104 (3076)	96 (2839)

CB832

Gas Sterndrive

Routine Maintenance *	Each Day Start	Each Day End	Weekly	Every Two Months
Check crankcase oil (interval can be extended based on experience).	★			
If operating in salt, brackish or polluted waters, flush cooling system after each use.		★		
Check drive unit oil level, trim pump oil level and power steering pump fluid level.			★	
Check water pickups for debris or marine growth. Check water strainer and clean. Check coolant level.			★	
Inspect drive unit anodes and replace if 50 percent eroded.			★	
Check battery connections and fluid level.				★
Lubricate propeller shaft and the retorque nut (if operating in only freshwater, this maintenance may be extended to every four months).				★
Operating in Saltwater Only: treat engine surface with corrosion guard.				★

* Only perform maintenance which applies to your particular power package

Gas Sterndrive (Continued)

Scheduled Maintenance *

	Annually	Every 100 Hours or Annually ◆	Every 200 Hours or 3 Years ◆	Every 300 Hours or 3 Years ◆	Every 2 Years	Every 5 Years
Touch-up paint power package and spray with corrosion guard.	★					
Change crankcase oil and filter.		★				
Change drive unit oil and retorque connection of gimbal ring to steering shaft.		★				
Replace fuel filter.		★				
Check steering system and remote control for loose, missing or damaged parts. Lubricate cables and linkages.		★				
Inspect and lubricate U-joints and splines; inspect bellows and clamps. Check engine alignment.			★			
Lubricate gimbal bearing and engine coupler.			★[8]			
Check continuity circuit for loose or damaged connections. Test MerCathode® unit output on Bravo models.			★			
Retorque engine mounts.				★		
Check spark plugs, wires, distributor cap and ignition timing. Check and adjust idle speed.				★		
Clean flame arrestor.		★				
Check electrical system for loose, damaged or corroded fasteners.				★		
Inspect condition and tension of belts.				★		
Check cooling system and exhaust system hose clamps for tightness. Inspect both systems for damage or leaks.				★		
Disassemble and inspect seawater pump and replace worn components.				★		
Clean seawater section of closed cooling system. Clean, inspect and test pressure cap.				★		
Replace coolant.						★
Lubricate driveshaft U-joints and tailstock input and output bearings.		★				

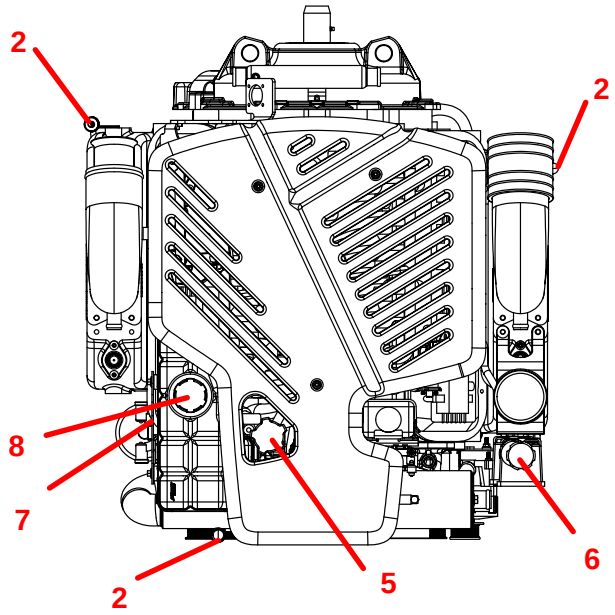
* Only perform maintenance which applies to your particular power package

◆ Whichever Occurs First

[8] Lubricate engine coupler every 50 hours if operated at idle for prolonged periods of time.

CB831

Checking Fluid Levels



77631

⚠CAUTION

Mercury MerCruiser recommends that the crankcase oil be checked BEFORE starting the engine. If it is necessary to check the oil level after starting the engine, stop engine and allow a minimum of 10 minutes for the oil to drain back into the oil pan.

CHECKING CRANKCASE OIL

IMPORTANT: Boat must be at rest in the water to obtain an accurate reading in the following procedure.

1 Check oil level before starting engine.

2 Remove dipstick. Wipe clean.

NOTE: *Ensure that dipstick is installed with oil level indication marks facing the rear of the engine (flywheel end).*

3 Reinstall dipstick fully into dipstick tube. Wait 60 seconds to allow trapped air to vent.

4 Remove dipstick and observe oil level. Oil level must be between FULL or OK RANGE and ADD. If oil level is below ADD:

5 Remove oil filler cap. Add specified oil to bring level up to, but not over, FULL or OK RANGE mark on dipstick.

IMPORTANT: DO NOT overfill crankcase oil.

CA886

CHECKING POWER STEERING PUMP FLUID

Stop engine and position drive unit straight back.

6 Remove FILL CAP/DIPSTICK and observe level. Add specified fluid if required. Reinstall FILL CAP/DIPSTICK.

IMPORTANT: If fluid is not visible in pump, contact your Authorized Mercury MerCruiser Dealer.

CC1042

CHECKING ENGINE COOLANT

⚠ WARNING

Avoid serious injury from burns. Do not remove coolant cap when engine is hot. Coolant may discharge violently.

IMPORTANT: Check engine coolant BEFORE starting engine.

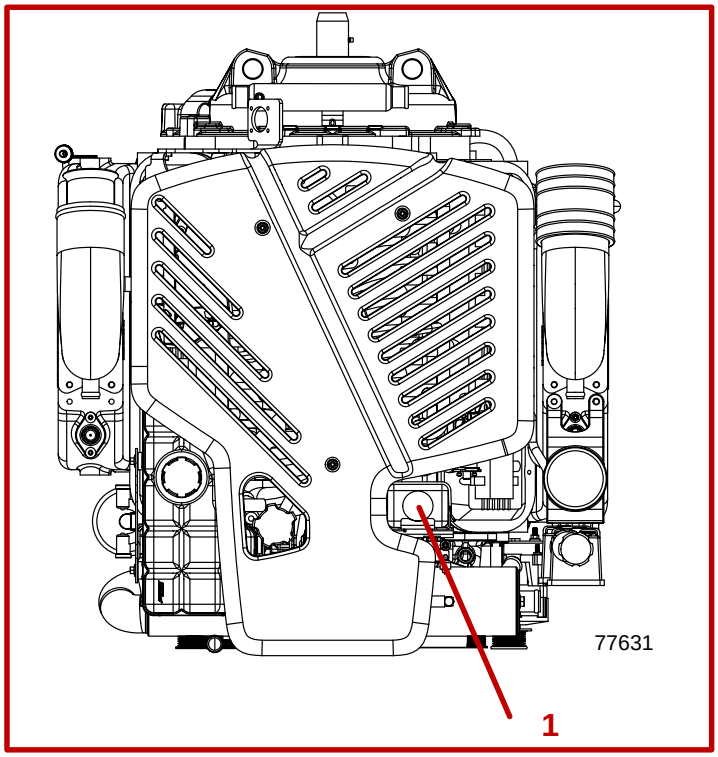
7 Check coolant level in coolant reservoir. Add specified coolant as required.

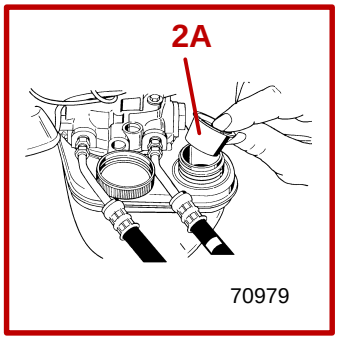
8 If coolant is low, inspect gasket in cap for damage and replace if necessary.

9 Inspect coolant recovery system for leaks.

CB828

Checking Fluid Levels (Continued)





CA888

CHECKING DRIVE UNIT OIL

NOTE: *Oil level will fluctuate during operation. Oil level should be checked with cold engine before starting.*

1 Check gear lube monitor oil level. Keep oil level at or near FULL line. If any water is visible at the bottom of monitor or appears at the oil fill/drain plug and/or if oil appears discolored, contact your Authorized Mercury MerCruiser Dealer immediately. Both conditions may indicate a water leak somewhere in the drive unit.

IMPORTANT: If more than 2 fl. oz. (59ml) of Quicksilver High Performance Gear Lube is required to fill monitor, a seal may be leaking. Damage to drive unit may occur due to lack of lubrication. Contact your Authorized Mercury MerCruiser Dealer for service.

CA942

CHECKING POWER TRIM PUMP FLUID

Place drive unit in full down/in position.

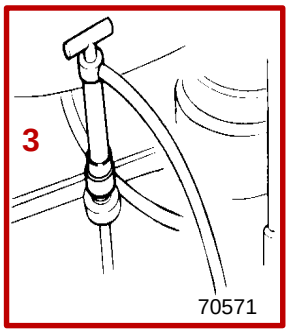
2 Remove fill cap from reservoir and observe oil level. Level must be up to, but not over bottom of filler neck. Add Quicksilver Power Trim and Steering Fluid or SAE 10W-30 motor oil, if required, to bring level to bottom of filler neck. Replace cap.

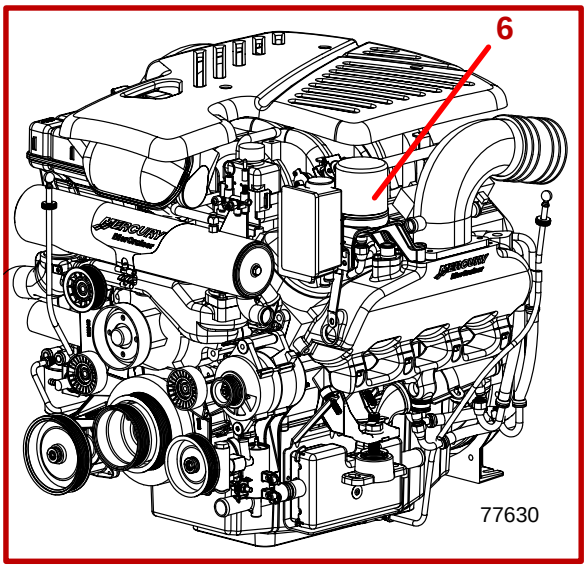
A Check that cap plug has been **removed** from filler neck and **discarded.**

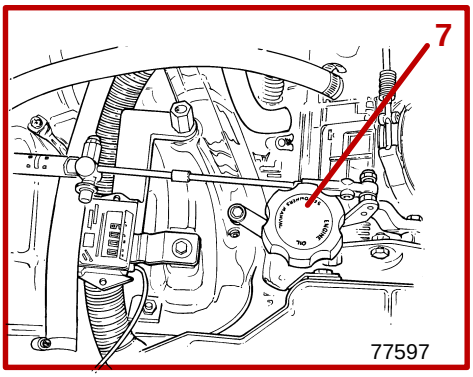
B Fill cap is vented.

CB836

Changing Fluids







Refer to Maintenance for change interval. Crankcase oil should be changed before placing boat in storage. Power Trim or Power Steering fluids do not require changing.

Changing Crankcase Oil and Filter

IMPORTANT: Change crankcase oil when engine is warm from operation. Warm oil flows more freely, carrying away more impurities. Use only recommended engine oil (refer to Specifications).

1 With engine at normal operating temperature, remove drain plug from oil drain hose or remove dipstick.

NOTE: *If engine is factory equipped with Quick Drain Oil Hose, pull tether through bilge drain before removing drain plug from oil drain hose.*

2 Drain crankcase oil using quick drain oil hose.

NOTE: *If drain plug is not accessible because of boat construction, oil may be removed through dipstick tube, using a Quicksilver Crankcase Oil Pump. (See Quicksilver Accessory Guide.)*

3 Drain crankcase oil using Quicksilver Crankcase Oil Pump.

A Insert hose end of crankcase oil pump onto an appropriate container and using handle, pump until crankcase is empty.

B Remove pump.

4 After oil has drained completely, reinstall drain plug or dipstick and tighten securely.

5 Remove and discard oil filter and its sealing ring.

6 Coat sealing ring on new filter with engine oil and install. Tighten filter securely (following filter manufacturer's instructions). DO NOT overtighten.

7 Remove oil filler cap. Add recommended engine oil to bring level up to, but not over, FULL or OK RANGE mark on dipstick. Refer to Specifications.

8 Start engine and check for leaks.

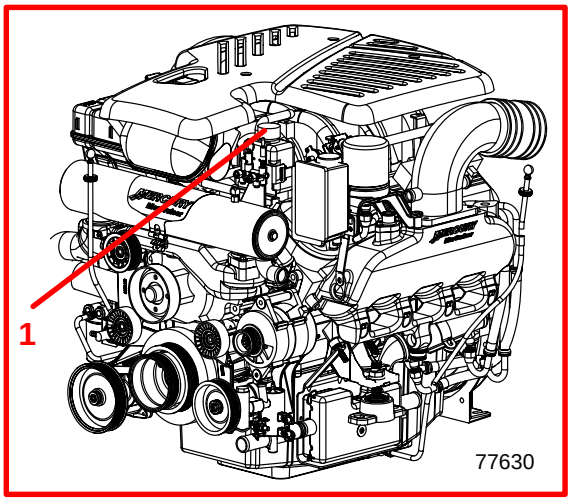
IMPORTANT: Always use dipstick to determine exactly how much oil is required.

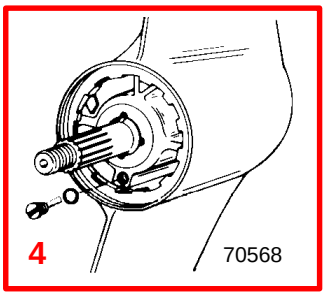
⚠CAUTION

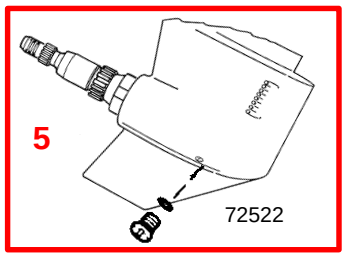
ENVIRONMENTAL HAZARD! Discharge of oil or oil waste into the environment is restricted by law. Do not spill oil or oil waste into the environment when using or servicing your boat. Contain and dispose of oil or oil waste as defined by local authorities.

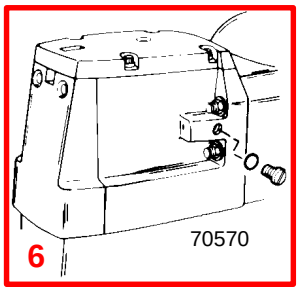
CB808

Changing Drive Unit Oil









1 Remove gear lube monitor bottle from bracket.

2 Empty contents into suitable container.

3 Install monitor in bracket.

4 **Bravo One Models:** Remove propeller, place drive unit in full trim limit IN position, remove OIL FILL/DRAIN SCREW and sealing washer and drain oil.

5 **All Other Models:** Place drive unit in full trim limit OUT position, remove OIL FILL/DRAIN SCREW and sealing washer and drain oil.

6 Remove OIL VENT screw and sealing washer. Allow oil to drain completely.

IMPORTANT: If any water drained from OIL FILL/DRAIN hole, or if oil appears milky, drive unit is leaking and should be checked immediately by your Authorized Mercury MerCruiser Dealer.

7 Lower drive unit so propeller shaft is level. Fill drive unit, through OIL FILL/DRAIN hole, with specified gear lube until an air-free stream of lubricant flows from OIL VENT hole.

IMPORTANT: Use only Quicksilver High Performance Gear Lube in drive unit.

8 Install OIL VENT screw and sealing washer.

9 Continue to pump gear lube into the gear lube monitor circuit until gear lube appears in the gear lube monitor.

10 Fill monitor to FILL mark. Lubricate O-ring on neck with gear lube. Install cap; DO NOT overtighten.

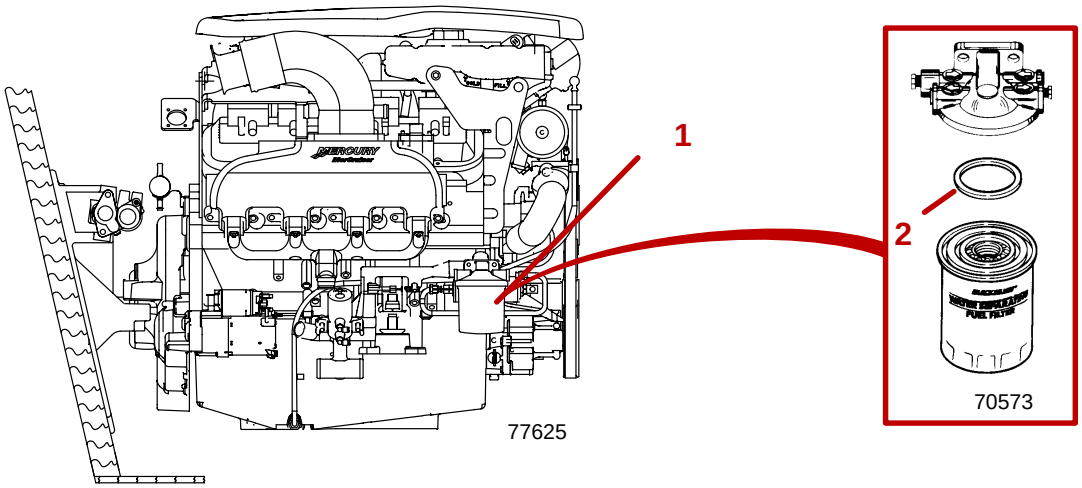
11 Remove pump from OIL FILL/DRAIN hole. Quickly install sealing washer and OIL FILL/DRAIN screw. Tighten securely.

12 **Bravo One:** Grease propeller shaft heavily, with specified lubricant (Refer to Propeller Installation). Reinstall propeller and torque nut to 55 lb-ft (75 Nm) minimum.

13 Recheck oil level after first use.

IMPORTANT: Oil level in gear lube monitor will rise and fall during drive operation; always check oil level when drive is cool and engine is shut down.

Changing Water Separating Fuel Filter



⚠ WARNING

Avoid Fire or Explosion: Fuel injection system is pressurized during operation. Use care when removing water separating fuel filter. Fuel could spray on hot engine causing fire or explosion. Allow engine to cool down before attempting to remove the water separating fuel filter in the following procedure. Also, hold a clean shop towel over the water separating fuel filter when removing it, to help avoid fuel spraying on the engine.

⚠ WARNING

Be careful when changing water separating fuel filter. Gasoline is extremely flammable and highly explosive under certain conditions. Be sure ignition key is OFF. Do not smoke or allow spark or open flame in area when changing fuel filter. Wipe up any spilled fuel immediately.

⚠ WARNING

Make sure no fuel leaks exist before closing engine hatch.

⚠ CAUTION

The electric fuel pump and factory installed water separating fuel filter have been carefully designed to function properly together. Do not install additional fuel filters and/or water separating fuel filters between fuel tank and engine.

The installation of additional fuel filters and/or water separating fuel filters may cause:

- Fuel Vapor Locking
- Difficult Warm-Starting
- Piston Detonation Due to Lean Fuel Mixture
- Poor Driveability

1 Remove water separating fuel filter and sealing ring from mounting bracket. Discard filter and sealing ring.

⚠ CAUTION

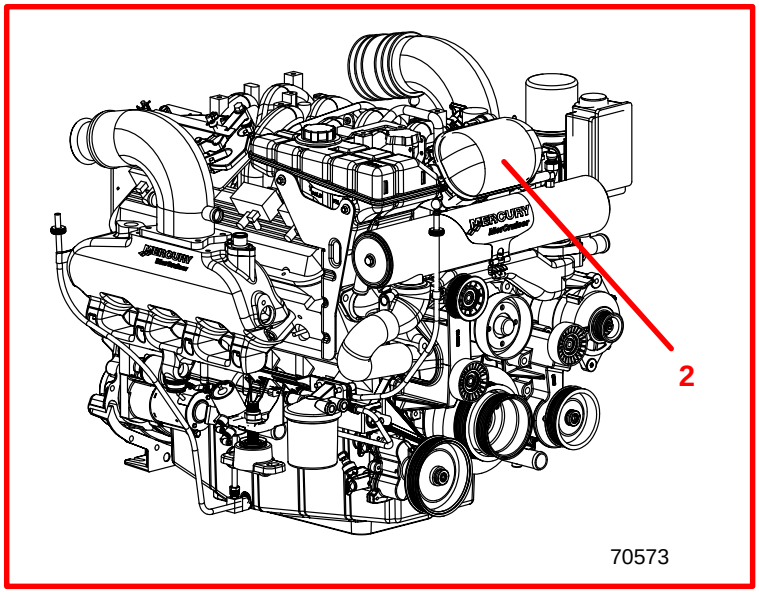
ENVIRONMENTAL HAZARD! Discharge of oil or oil waste into the environment is restricted by law. Do not spill oil or oil waste into the environment when using or servicing your boat. Contain and dispose of oil or oil waste as defined by local authorities.

2 Coat sealing ring on new water separating fuel filter with engine oil. Thread water separating fuel filter onto bracket and tighten securely by hand. Do not use a filter wrench.

3 Start and operate engine. Check water separating fuel filter connection for gasoline leaks. If leaks exist, stop engine immediately and recheck filter installation. If leaks continue, contact your Authorized Mercury MerCruiser Dealer.

CC1021

Cleaning Flame Arrestor and Related Components



⚠ WARNING

Avoid gasoline fire or explosion. Gasoline is extremely flammable and highly explosive under certain conditions. Be careful when cleaning flame arrestor; ensure that ignition is OFF. DO NOT smoke or allow sources of spark or open flame in area when cleaning flame arrestor.

1 Remove engine cover.

2 Remove flame arrestor.

3 Clean flame arrestor with water or steam. Dry with compressed air or allow to air dry completely.

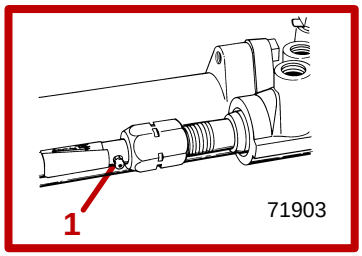
⚠ WARNING

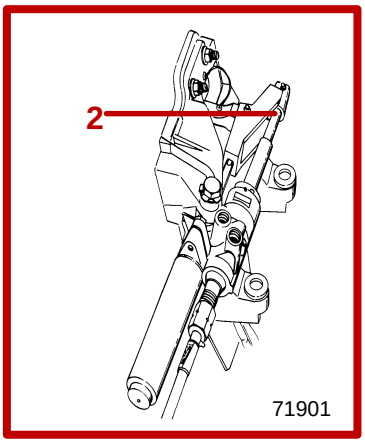
Avoid gasoline fire or explosion. Gasoline is extremely flammable and highly explosive under certain conditions. NEVER use gasoline as a cleaning solvent.

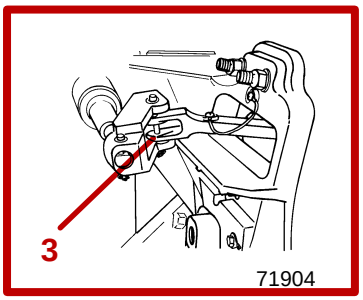
4 Reinstall flame arrestor.

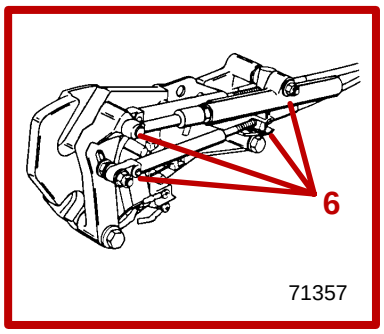
5 Tighten flame arrestor fastener securely.

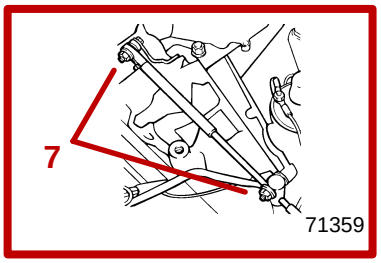
CA922











CA524

Lubrication

Steering System

1 **If Steering Cable Has Grease Fittings:** Turn steering until steering cable is fully retracted into cable housing. Apply approximately 3 pumps of grease from a typical hand-operated grease gun. Lubricate at fitting with 2-4-C Marine Lubricant with Teflon.

⚠ WARNING

Do not grease steering cable while extended. Hydraulic lock could occur and cause loss of steering control.

NOTE: *If steering cable does not have grease fitting, inner wire of cable cannot be greased.*

2 Turn steering until steering cable fully extended. Lubricate by applying a thin coat of Special Lubricant 101 on exposed part of cable.

3 Lubricate steering system pivot points with SAE 30W motor oil.

4 On dual engine boats: Lubricate all pivot points, including tie bar pivot points, with SAE 30W motor oil.

5 Upon first starting engine, turn steering wheel several times to starboard, and then port, to ensure that the steering system operates properly, before getting underway.

CA923

Shift Cable - Typical

6 Lubricate pivot points with SAE 30W motor oil.

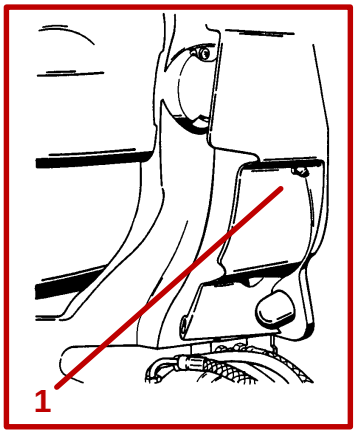
CB613

Throttle Cable

7 Lubricate pivot points with SAE 30W motor oil.

CB829

Lubrication (Continued)



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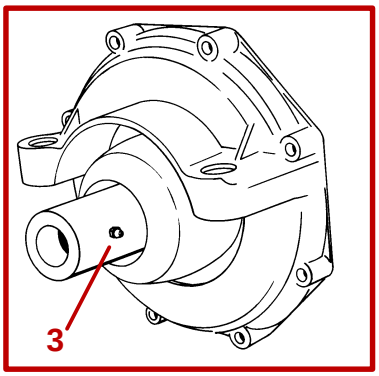


71569

CA525

Drive Unit and Transom Assembly

1 Lubricate gimbal bearing by applying approximately 8-10 pumps of grease from a typical hand-operated grease gun using Quicksilver U-Joint and Gimbal Bearing Grease.

2 For propeller shaft lubrication, see PROPELLER.

CB809

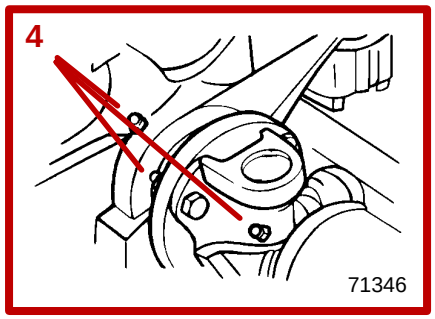
Engine Coupler

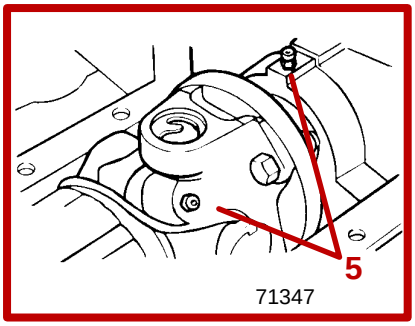
3 Lubricate engine coupler splines through grease fittings on coupler by applying approximately 8-10 pumps of grease from a typical hand-operated grease gun using Quicksilver Engine Coupler Spline Grease. If boat is operated at idle for prolonged periods of time, coupler should be lubricated every 50 hours.

NOTE: **Bravo Models** - *Your engine is equipped with a sealed engine coupler. The sealed coupler and shaft splines can be lubricated without removing the drive unit.*

NOTE: **Bravo Models** - *The crosses and bearings on the drive U-joint will need to be lubricated through the grease fittings. Apply Quicksilver U-joint and Gimbal Bearing Grease from a typical hand-operated grease gun until a small amount of grease begins to push out. The sterndrive unit must be removed to grease these fittings.*

CA930





CB777

Drive Shaft Extension Models

4 Lubricate drive shaft grease fittings, at transom end, by applying approximately 10 - 12 pumps of grease from a typical hand-operated grease gun using Quicksilver U-joint and Gimbal Bearing Grease.

5 Lubricate drive shaft grease fittings, at engine end, by applying approximately 3 - 4 pumps of grease from a typical hand-operated grease gun using Quicksilver U-joint and Gimbal Bearing Grease.

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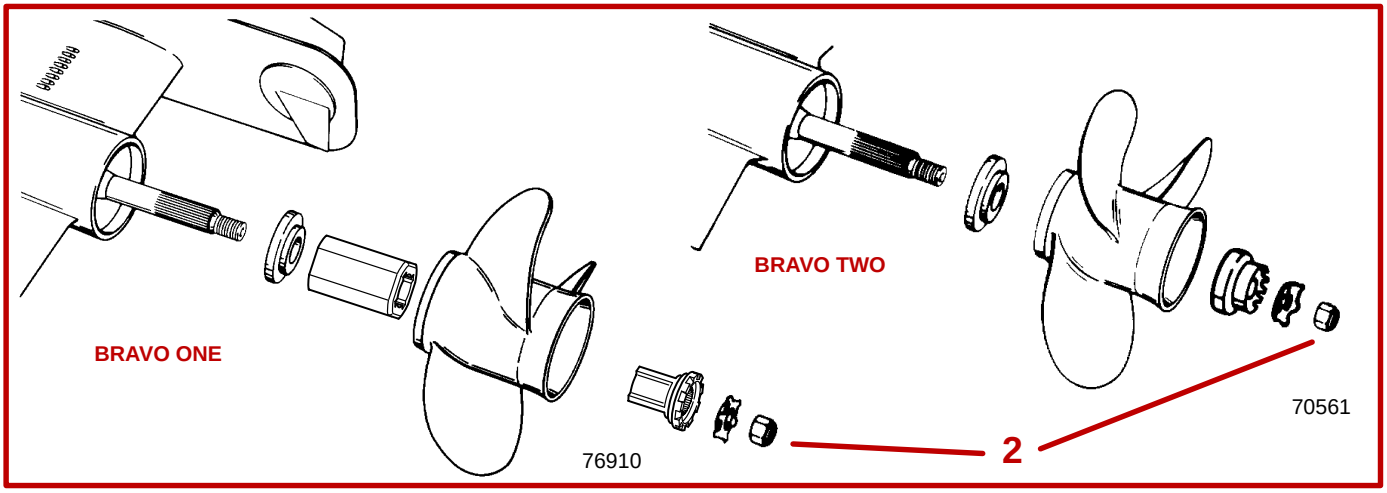
CA817

Propellers

Bravo One and Two



⚠ WARNING

Avoid Injury: Remote Control must be in NEUTRAL and ignition key removed from switch before removing and/or installing propeller.

⚠ WARNING

Avoid Injury: Place a block of wood between anti-ventilation plate and propeller to protect hands from propeller blades and to prevent propeller from rotating when removing propeller nut.

⚠ CAUTION

Avoid Injury: Periodically check propeller nut for tightness during boating season. A minimum of 55 lb-ft (75 Nm) torque is required.

CA743

REMOVAL

1. Place wood block between propeller blade and anti-ventilation plate to prevent rotation. Straighten bent tabs on tab washer.
2. Turn propeller shaft nut counterclockwise to remove nut.
3. Slide tab washer, spline washer, propeller and thrust hub off propeller shaft.

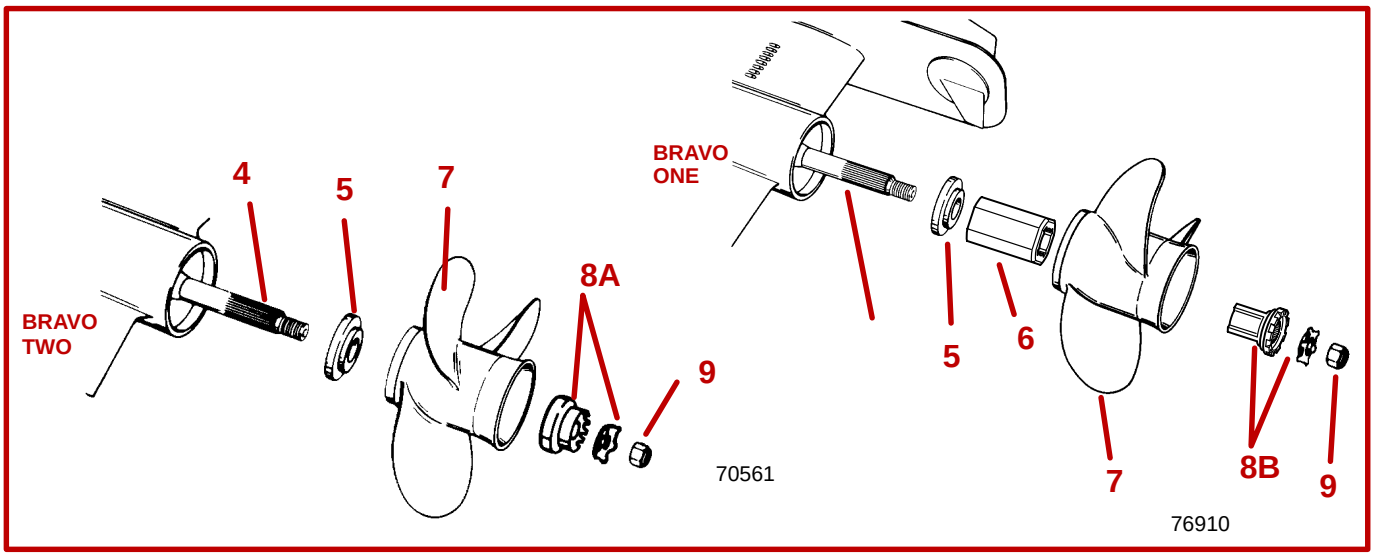
CA79

REPAIR

Some damaged propellers can be repaired. See your dealer.

CA818

INSTALLATION



IMPORTANT: If reusing tab washer, carefully inspect tabs for cracks or other damage. Replace tab washer if condition is questionable.

4 Apply a liberal coat of one of the following Quicksilver lubricants to propeller shaft: Anti-Corrosion Grease, Special Lubricant 101 or 2-4-C Marine Lubricant with Teflon.

5 Slide thrust hub into propeller hub, with stepped side toward propeller hub.

6 **Bravo One:** Install Flo-Torque II Drive Hub into propeller.

NOTE: *The drive sleeve is tapered and will slide fully into the propeller as the nut is tightened and properly torqued.*

7 Align splines and place propeller on propeller shaft.

8 Install final attaching hardware.

A **Bravo One:** Install drive sleeve adapter and locking tab washer.

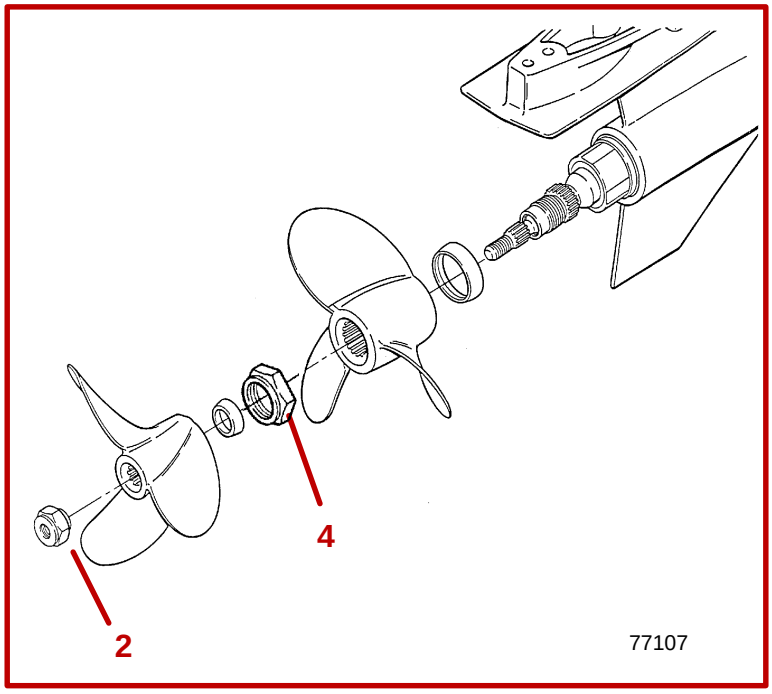
B **Bravo Two:** Install spline washer and tab washer.

9 Install propeller nut. Tighten nut securely. A minimum of 55 lb-ft (75 Nm) torque is required. Bend three tabs on tab washer down into grooves in spline washer. After first use, bend the three tabs straight, retighten propeller nut to minimum 55 lb-ft torque (75 Nm). Bend tabs back down into spline washer. Check propeller at least every 20 hours of operation. Do not operate with loose propeller.

CB830

Propellers

Bravo Three



⚠ WARNING

Avoid Injury: Remote Control must be in NEUTRAL and ignition key removed from switch before removing and/or installing propeller.

⚠ WARNING

Avoid Injury: Place a block of wood between anti-ventilation plate and propeller to protect hands from propeller blades and to prevent propeller from rotating when removing propeller nut.

⚠ CAUTION

Avoid Injury: Periodically check propeller nut for tightness during boating season.

REMOVAL

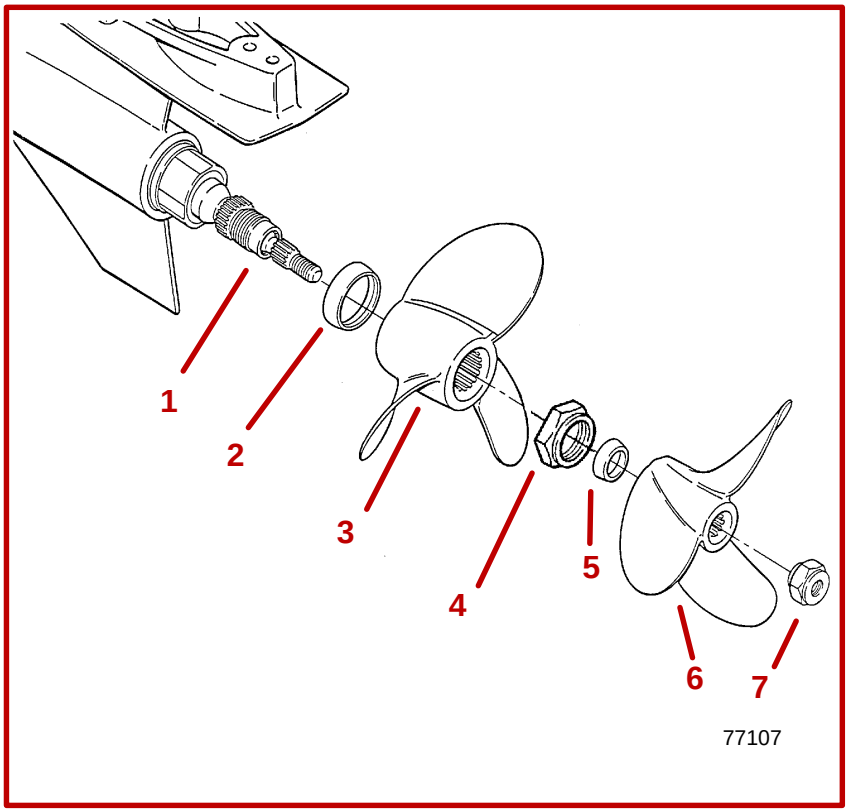
1. Place wood block between propeller blades and anti-ventilation plate to prevent rotation.
2. Turn aft propeller shaft nut (1-7/16 in. or 37 mm) counterclockwise to remove nut.
3. Slide propeller and thrust hub off propeller shaft.
4. Turn front propeller shaft nut (2-3/4 in. or 70 mm) counterclockwise to remove nut.
5. Slide propeller and thrust hub off propeller shaft.

REPAIR

Some damaged propellers can be repaired. See your dealer.

CA820

INSTALLATION



1 Apply a liberal coat of one of the following Quicksilver lubricants to both propeller shafts: Special Lubricant 101, 2-4-C Marine Lubricant with Teflon, or Anti-Corrosion Grease.

2 Slide forward thrust hub onto propeller shaft, with tapered side toward propeller hub (toward end of shaft).

3 Align splines and place propeller on propeller shaft.

4 Install propeller nut. Tighten nut securely. A minimum of 100 lb-ft (136 Nm) torque is required. Check propeller at least after 20 hours of operation. Do not operate with loose propeller.

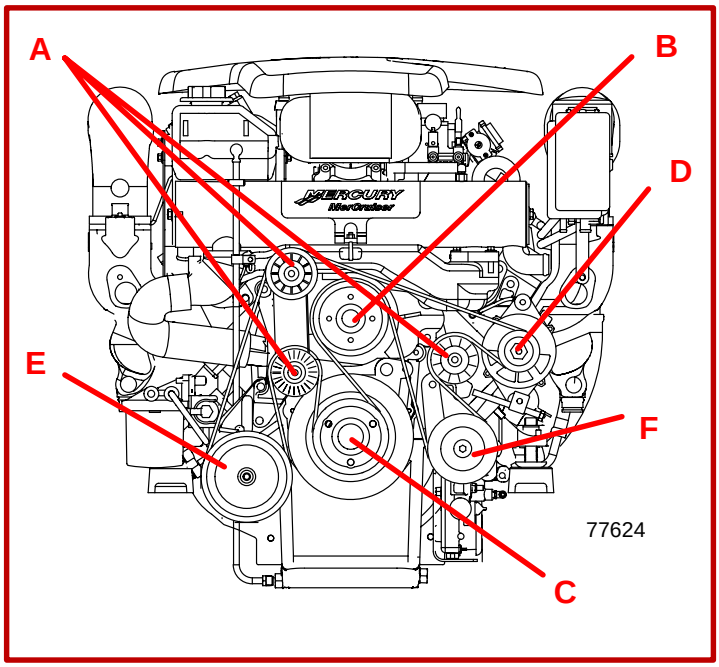
5 Slide aft thrust hub onto propeller shaft, with tapered side toward propeller hub (toward end of shaft).

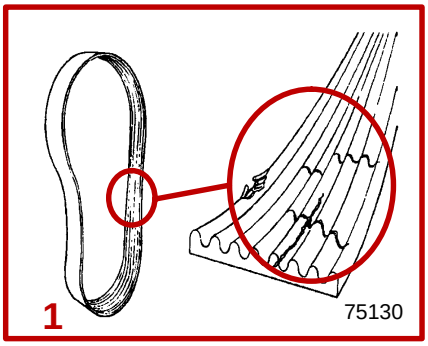
6 Align splines and place propeller on propeller shaft.

7 Install propeller nut. Tighten nut securely. A minimum of 60 lb-ft (81 Nm) torque is required. Check propeller at least after 20 hours of operation. Do not operate with loose propeller.

CA947

Serpentine Drive Belt





⚠ WARNING

Avoid possible serious injury. Make sure engine is shut off and ignition key is removed before inspecting belt.

The various components are:

- **A** Idler Pulley
- **B** Circulating Pump Pulley
- **C** Crankshaft Pulley
- **D** Alternator Pulley
- **E** Seawater Pump Pulley
- **F** Power Steering Pulley

CHECKING

1 Inspect drive belt for proper tension and for the following:

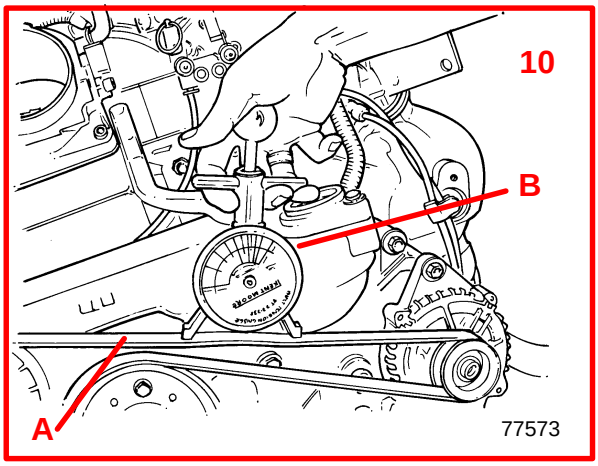
- Excessive wear
- Cracks

NOTE: *Minor, transverse cracks (across the belt width) may be acceptable. Longitudinal cracks (in direction of belt length) that join transverse cracks are NOT acceptable.*

- Fraying
- Glazed surfaces
- Proper tension - 1/4 in. (6 mm) deflection, with moderate thumb pressure, on the belt at the location that has the longest distance between two pulleys.

CB845

REPLACING AND / OR ADJUSTING TENSION



1 Loosen alternator attaching bolt.

2 Loosen tension bolt retainer nut.

3 Loosen tension bolt.

4 Move alternator to relieve tension on drive belt.

IMPORTANT: If a belt is to be reused, it should be installed in the same direction of rotation as before.

5 If belt is to be reused, mark direction of rotation.

6 Remove belt.

7 Install drive belt on pulleys.

8 Position tension bolt into idler pulley bracket.

9 Tighten tension bolt until belt is taut.

NOTE: *Belt deflection is to be measured on the belt at the location that has the longest distance between two (2) pulleys.*

10 Check belt deflection between the upper idler pulley and the alternator pulley using one of the following methods.

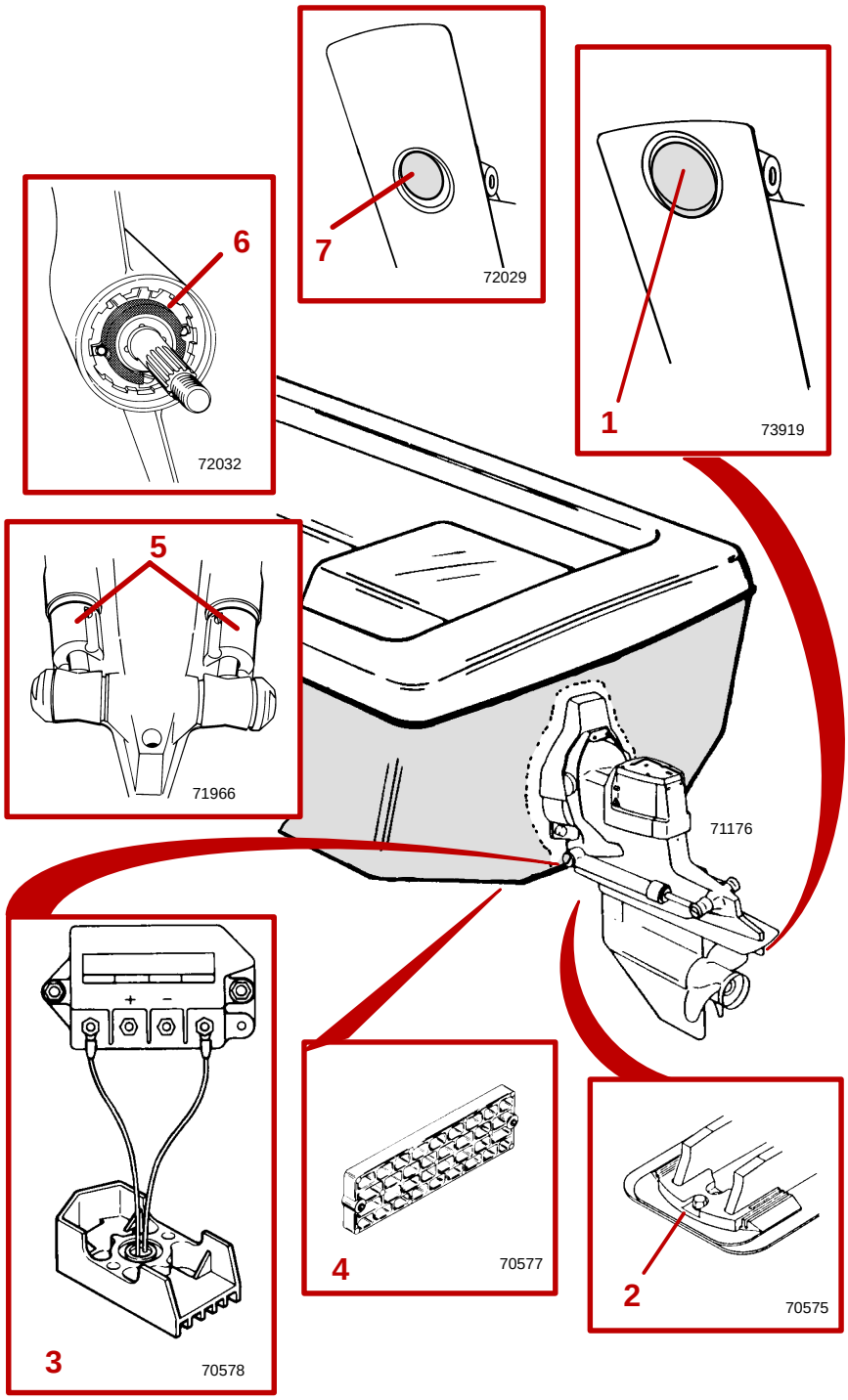
A If Kent Moore Belt Tension Gauge is not available, belt deflection can be checked by applying moderate downward pressure on belt. Proper deflection is approximately 1/4 in. (6 mm). Belt should not be replaced without using this tool.

B Attach Kent Moore Belt Tension Gauge to belt. Gauge has different ranges for new and used belts.

11 Securely tighten tension stud retainer nut.

12 Tighten alternator attaching bolt and nut.

13 Operate the engine for a short period of time. Recheck belt adjustment.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CB793

Corrosion And Corrosion Protection

Whenever two or more dissimilar metals (like those found on the sterndrive) are submerged in a conductive solution, such as saltwater, polluted water, or water with a high mineral content, a chemical reaction takes place causing electrical current to flow between metals. The electrical current flow causes the metal that is most chemically active, or anodic, to erode. This is known as galvanic corrosion and, if not controlled, it will in time cause the need for replacement of power package components exposed to water.

IMPORTANT: Replace sacrificial anodes if eroded 50% or more.

1 **Universal Anodic Plate -** serves as a sacrificial anode.

2 **Anodic Plate -** serves as a sacrificial anode.

3 **MerCathode System -** should be tested to ensure adequate output.

Test should be made where boat is moored, using Quicksilver Reference Electrode and Test Meter. Contact your Authorized Mercury MerCruiser Dealer to arrange for this test.

4 **Anode Kit (if equipped) -** Mounted to boat transom. Acts as a sacrificial anode.

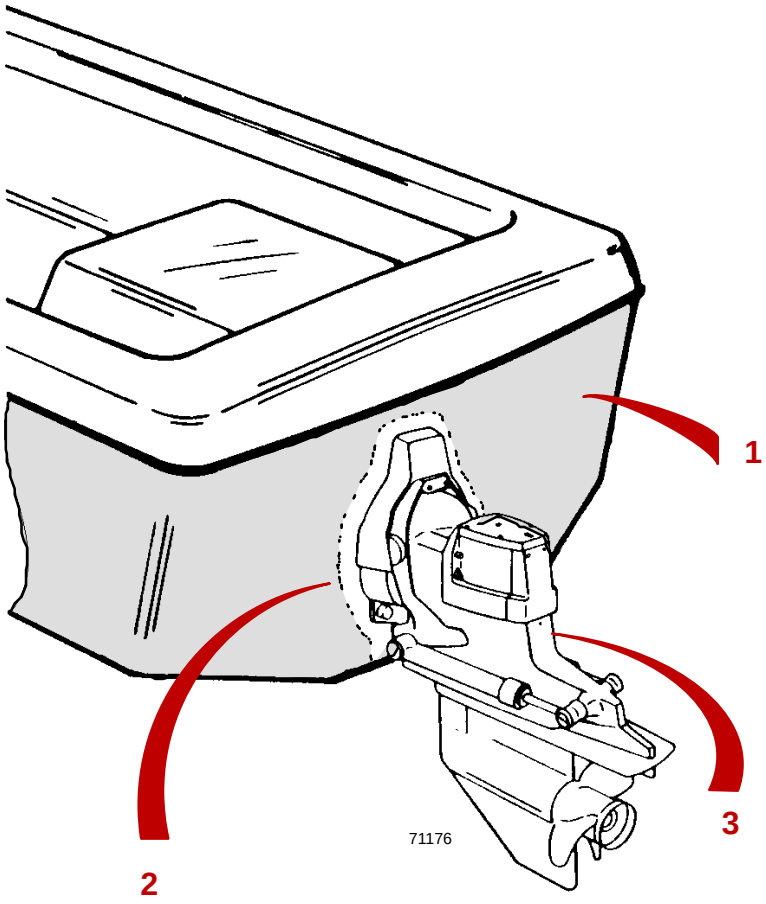
CA440

5 **Trim Cylinder Anodes -** are mounted on each trim cylinder.

CB764

6 **Bearing Carrier Anode (Bravo One) -** is located in front of the propeller, between the front side of the propeller and the gear housing. Refer to Propeller section in this manual for propeller removal and installation.

7 **Gear Housing Anode (Bravo Two and Three) -** is located in the splash plate, just above the propellers.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CA965

In addition to the corrosion protection devices, the following steps should be taken to inhibit corrosion:

IMPORTANT: Corrosion damage that results from the improper application of anti-fouling paint will not be covered by the limited warranty.

1 **Painting Boat Hull or Boat Transom:** Anti-fouling paint may be applied to boat hull and boat transom but you must observe the following precautions:

IMPORTANT: DO NOT paint anodes or MerCathode System reference electrode and anode, as this will render them ineffective as galvanic corrosion inhibitors.

IMPORTANT: If anti-fouling protection is required for boat hull or boat transom, copper or tin base paints, if not prohibited by law, can be used. If using copper or tin based anti-fouling paints, observe the following:

2 **Avoid any electrical interconnection between the Mercury MerCruiser Product, Anodic Blocks, or MerCathode System and the paint by allowing a minimum of 1-1/2 in. (40 mm) UNPAINTED area on transom of the boat around these items.**

3 **Painting Drive Unit or Transom Assembly:** Drive unit and transom assembly should be painted with a good quality marine paint or an anti-fouling paint that DOES NOT contain copper, tin, or any other material that could conduct electrical current. Do not paint drain holes, anodes, MerCathode system, and items specified by boat manufacturer.

4 Spray power package components on inside of boat annually with Quicksilver Corrosion Guard to protect finish from dulling and corrosion. External power package components may also be sprayed.

5 All lubrication points, especially steering system, shift and throttle linkages, should be kept well lubricated.

6 Flush cooling system periodically, preferably after each use.

CA478

Miscellaneous Maintenance

Battery

All lead acid batteries discharge when not in use. Recharge every 30 to 45 days, or when specific gravity drops below battery manufacturer's specifications.

Refer to specific instructions and warnings accompanying your battery. If this information is not available, observe the following precautions when handling a battery.

⚠ WARNING

Avoid serious injury from gasoline fire or explosion. Do not use jumper cables and a booster battery to start engine. Do not recharge a weak battery in the boat. Remove battery and recharge in a ventilated area away from fuel vapors, sparks or flames.

⚠ WARNING

Batteries contain acid which can cause severe burns-Avoid contact with skin, eyes and clothing. Batteries also produce hydrogen and oxygen gases when being charged. This explosive gas escapes fill/vent cell caps and may form an explosive atmosphere around the battery for several hours after it has been charged. Sparks or flames can ignite the gas and cause an explosion which may shatter the battery and could cause blindness or other serious injury.

Safety glasses and rubber gloves are recommended when handling batteries or filling with electrolyte. Hydrogen gases that escape from the battery during charging are explosive. When charging batteries, be sure battery compartment or area where batteries are located, is well-vented. Battery electrolyte is a corrosive acid and should be handled with care. If electrolyte is spilled or splashed on any part of the body, immediately flush the exposed area with liberal amounts of water and obtain medical aid as soon as possible.

CA962

Inspection And Maintenance

Inspect power package often, and at regular intervals, to help maintain its top operating performance and correct potential problems before they occur. The entire power package should be checked carefully, including all accessible engine parts.

Check for loose, damaged or missing parts, hoses and clamps; tighten or replace as required.

Check plug leads and electrical leads for damage.

Remove and inspect propeller. If badly nicked, bent or cracked, see your Authorized Mercury MerCruiser Dealer.

Repair nicks and corrosion damage on power package exterior finish. Use Quicksilver spray paints - see your Authorized Mercury MerCruiser Dealer.

CB838

Cold Weather And Extended Storage

IMPORTANT: Mercury MerCruiser strongly recommends that this service should be performed by an authorized Mercury MerCruiser dealer. Damage caused by freezing IS NOT covered by the Mercury MerCruiser Limited Warranty.

⚠ CAUTION

Sterndrive unit should be stored in the full DOWN position. Universal joint bellows may develop a "set" if unit is stored in raised position and may fail when unit is returned to service.

IMPORTANT: Mercury MerCruiser recommends that propylene glycol antifreeze (a nontoxic and environmentally safe antifreeze) be used in the seawater section of the cooling system for cold weather or extended storage. Ensure that the propylene glycol antifreeze contains a rust inhibitor and is recommended for use in marine engines. Be certain to follow the propylene glycol manufacturer's recommendations.

⚠ CAUTION

The seawater section of the cooling system MUST BE COMPLETELY drained for winter storage, or immediately after cold weather use, if the possibility of freezing temperatures exist. Failure to comply may result in trapped water causing freeze and/or corrosion damage to the engine. Damage caused by freezing is NOT covered by the Mercury MerCruiser Limited Warranty.

Preparing Your Power Package For Storage

1. Fill the fuel tanks with fresh gasoline (that does not contain alcohol) and a sufficient amount of Mercury Fuel System Treatment and Stabilizer to treat the gasoline. Follow instructions on the container.
2. **If the boat is to be placed in storage with fuel containing alcohol in fuel tanks (if fuel without alcohol is not available):** Fuel tanks should be drained as low as possible and Quicksilver Gasoline Stabilizer for Marine Engines added to any fuel remaining in the tank.

NOTE: *If desired, a portable fuel tank can be used to perform the remainder of the power package lay up procedures. Be sure to add an appropriate amount of Gasoline Stabilizer to the portable tank.*

3. Flush the cooling system.
4. Change the oil and oil filter.

FUEL SYSTEM

⚠ WARNING

The fuel injection system is pressurized. Avoid serious injury from an explosion. Use care when removing water separating fuel filter. Allow engine to cool down before removing the water separating fuel filter. Also, hold a clean shop towel over the water separating fuel filter when removing it, to help avoid fuel spraying on the engine.

⚠ WARNING

Fuel vapors can be present in the engine compartment. Avoid injury or power package damage caused by fuel vapors or explosion. Always ventilate the engine compartment prior to servicing the power package.

1 In a 6 U.S. gal (23 liter) remote fuel tank mix:

A 5 U.S. gal (19 liter) regular unleaded 87 octane (90 RON) gasoline

B 2 U.S. qts. (1.89 liter) Premium Plus 2-Cycle TC-W3 Outboard Oil

C 5 ounces (150ml) Fuel System Treatment and Stabilizer or 30 ml (1 ounce) Fuel System Treatment and Stabilizer Concentrate.

Description	Where Used	Part Number
Mercury Fuel System Treatment and Stabilizer	Fuel System	92-802875A1
Mercury Fuel System Treatment and Stabilizer Concentrate	Fuel System	92-802876A1
Premium Plus 2-Cycle TC-W3 Outboard Oil	Fuel System	92-802824A1

2 Allow the engine to cool down.

3 Activate the Schrader valve to relieve fuel pressure.

4 Close the fuel shut-off valve, if equipped. Disconnect and plug the fuel inlet fitting if not equipped with a fuel shut-off valve.

5 Connect the remote fuel tank (with the fogging mixture) to the fuel inlet fitting.

IMPORTANT: Supply cooling water to the engine.

6 Start and operate the engine at 1300 rpm for 5 minutes.

7 After specified operating time is complete, slowly return throttle to idle rpm and shut engine off.

IMPORTANT: Ensure that some fogging mixture remains in the engine. Do NOT allow the engine's fuel system to become completely dry.

8 Remove and discard the water separating fuel filter.

9 Install a new filter.

BATTERY

Follow the battery manufacturer's instructions for storage.

CB816

Store boat with drive unit in full DOWN/IN position.

CC1023

Draining Instructions

NOTE: *If recommended coolant is unavailable, any type of ethylene glycol based antifreeze may be used, but it will require replacement every two years.*

IMPORTANT: Drain seawater section of closed cooling system only.

IMPORTANT: Boat must be as level as possible to ensure complete draining of cooling system.

⚠CAUTION

Seawater section of cooling system MUST BE COMPLETELY drained for winter storage or immediately after cold weather use if the possibility of freezing temperatures exist. Failure to comply may result in trapped water causing freeze and/or corrosion damage to engine. Damage caused by freezing IS NOT covered by the Mercury MerCruiser Limited Warranty.

⚠CAUTION

If engine will be exposed to freezing temperatures, ensure closed cooling section is filled with an ethylene glycol antifreeze and water solution properly mixed to protect engine to lowest temperature to which it will be exposed.

IMPORTANT: Closed cooling section must be kept filled year-round with recommended coolant.

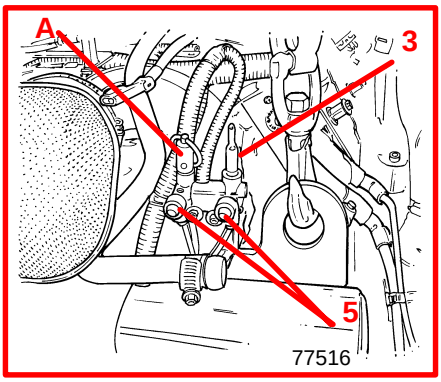
IMPORTANT: Do not use Propylene Glycol Antifreeze in the closed cooling section of the engine.

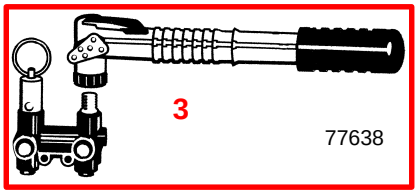
⚠CAUTION

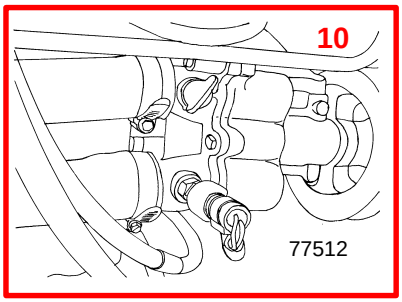
Ensure that boat is out of the water or seacock is closed and that bilge pump is operating. Excess water in the bilge can damage engine or cause boat to sink.

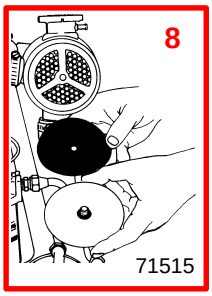
CC1024

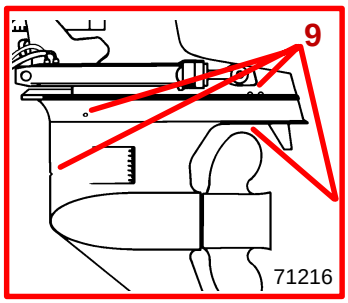
SINGLE POINT DRAIN SYSTEM











⚠CAUTION

Freeze damage can occur, if operating where temperatures are below 32 degrees F (0 degrees C). Use Manual Drain System to ensure heat exchanger is completely drained.

NOTE: *This procedure is written for the air pump that is attached to the engine. However, any air source can be used.*

1 Remove air pump from engine.

2 Ensure that lever on top of pump is flush with the handle (horizontal).

3 Install air pump on the actuator fitting.

4 Pull lever on air pump up (vertical) to lock pump on actuator fitting.

5 Pump air into the system until both green indicators extend and water drains from both sides of the engine.

6 Most water will drain from the engine in 3-4 minutes, however, some will remain trapped in the heat exchanger. In order to prevent freeze damage, leave system pressurized while transporting boat or during other maintenance items to allow the remaining water to drain.

IMPORTANT: Before launching boat, pull up on manual release valve. Verify that green indicators are no longer extended. (A)

⚠CAUTION

Manual release valve may not close completely. Ensure valve is completely seated.

MANUAL DRAIN SYSTEM

NOTE: *If air actuated drain system fails, use the blue drain plugs to drain engine.*

NOTE: *It may be necessary to lift, bend or lower hoses to allow water to drain completely when hoses are disconnected.*

7 Remove blue drain plugs from front and rear of cool fuel cell and from the seawater pump.

8 Remove end caps, sealing washers and gaskets from heat exchangers.

9 Repeatedly clean out drain holes using a stiff piece of wire. Do this until entire system is drained.

10 Remove both hoses from seawater pump.

11 Crank engine over slightly with starter motor to purge any water trapped in seawater pickup pump. DO NOT ALLOW ENGINE TO START.

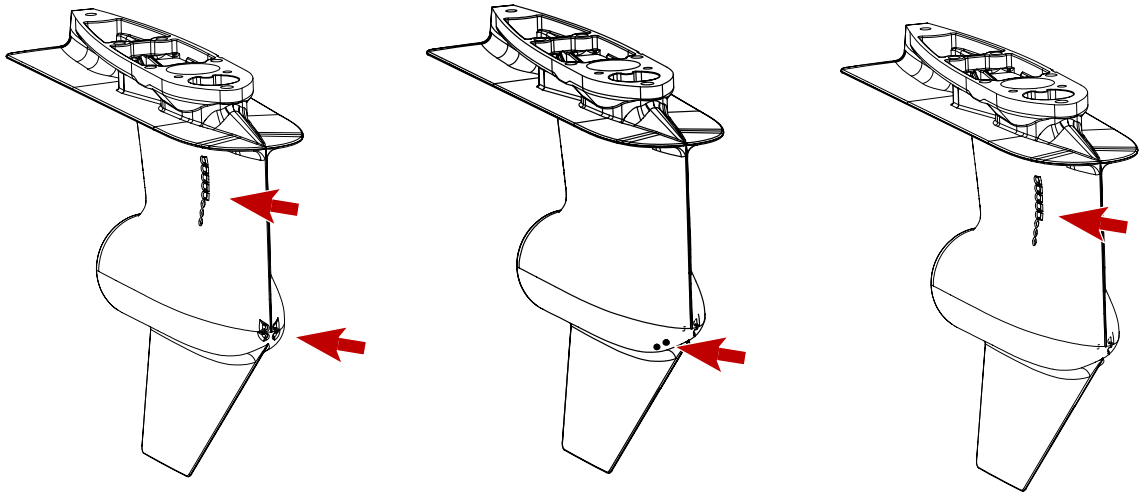
CB844

Flushing Cooling System

Your boat could come equipped with one of three different types of water pickups: through the hull, through the transom and through the sterndrive. The flushing procedures for these systems are separated into two categories: sterndrive water pickups and alternative water pickups. Consult your authorized Mercury MerCruiser dealer for further explanation.

Sterndrive Water Pickups

There are three types of water pickups available on Mercury MerCruiser sterndrives: low water, dual water and side pickups. Dual water pickups require the flushing attachment (44357Q2) and the flush seal kit (881150Q1), low water pickups require the flushing attachment (849996T1) and side pickups require the flushing attachment (44357Q2).



77899

Dual Water Pickup **Low Water Pickup** **Side Pickup**

NOTE: *Flushing is needed only for salty, brackish, mineral laden or polluted water applications. Flushing is recommended after each outing for best results.*

1 If flushing cooling system with boat in water:

A Raise drive unit to TRAILER position.

B Install appropriate flushing attachment over water intake openings in the gear housing.

C Lower drive unit to full DOWN/IN position.

2 If flushing cooling system with boat out of water:

A Lower drive unit to full DOWN/IN position.

⚠ WARNING

Contact with moving drive components and the propeller can cause personal injury or death. To avoid possible injury , remove the propeller and ensure that no people or animals are in the area of the drive unit while flushing.

B Remove propeller.

C Install Quicksilver flushing attachment (or equivalent) over water intake openings in gear housing.

3 Connect hose between flushing attachment and water source.

4 With drive unit in normal operating position, partially open water source (about 1/2 maximum).

5 Place drive in NEUTRAL, idle speed position and start engine.

⚠ CAUTION

Suction created by the seawater pickup pump may collapse the flushing water hose causing the engine to overheat. Avoid engine damage from overheating, DO NOT operate the engine above 1500 rpm.

6 Slowly advance throttle until engine reaches 1300 rpm (+/–100 rpm).

⚠ CAUTION

Engine overheating can cause engine damage. To avoid, observe the water temperature gauge and ensure the engine is operating in the normal range.

7 Observe the water temperature gauge to ensure the engine is operating in the normal range.

8 Operate engine with drive in NEUTRAL for about 5 minutes or until discharge water is clear.

9 Slowly return throttle to idle speed position.

10 Stop engine.

11 Shut off water and remove flushing attachment.

Alternative Water Pickups

NOTE: *Flushing is needed only for salty, brackish, mineral laden or polluted water applications. Flushing is recommended after each outing for best results.*

1 If flushing cooling system with boat in water:

A Raise drive unit to TRAILER position.

B Install appropriate flushing attachment over the water intake openings in the gear housing.

C Lower drive unit to full DOWN/IN position.

2 If flushing cooling system with boat out of water:

A Lower drive unit to full DOWN/IN position.

⚠ WARNING

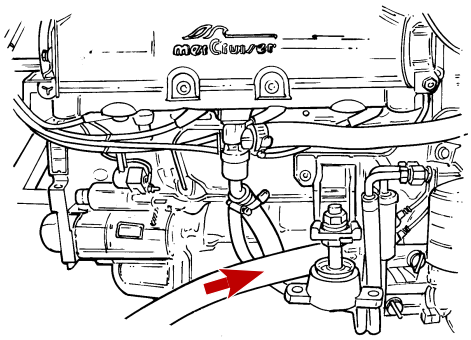
Contact with moving drive components and the propeller can cause personal injury or death. To avoid possible injury , remove the propeller and ensure that no people or animals are in the area of the drive unit while flushing.

B Remove propeller.

C Install Quicksilver flushing attachment (or equivalent) over water intake openings in gear housing.

3 Connect hose between flushing attachment and water source.

4 Disconnect the water inlet hose (upper hose) from the aft side of the seawater pump.



77945

5 Using a suitable adapter, connect the flushing hose from the water source to the water inlet of the sea pump.

⚠CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet holes during operation.

6 With drive unit in normal operating position, partially open the two water sources (about 1/2 maximum).

7 Place drive in NEUTRAL, idle speed position and start engine.

⚠CAUTION

Suction created by the seawater pickup pump may collapse the flushing water hose causing the engine to overheat. Avoid engine damage from overheating, DO NOT operate the engine above 1500 rpm.

8 Slowly advance throttle until engine reaches 1300 rpm (+/–100 rpm).

⚠CAUTION

Engine overheating can cause engine damage. To avoid, observe the water temperature gauge and ensure the engine is operating in the normal range.

9 Observe the water temperature gauge to ensure the engine is operating in the normal range.

10 Operate engine with drive in NEUTRAL for about 5 minutes or until discharge water is clear.

11 Slowly return throttle to idle speed position.

12 Stop engine.

13 Shut off water and remove flushing attachments.

14 Install the water inlet hose to the aft side of the seawater pump.

15 Tighten the hose clamp securely.

CA115

Battery Winter Storage

Follow battery manufacturer’s instructions for storage.

CC1026

Power Package Recommissioning

⚠ WARNING

To prevent possible injury or damage to equipment, do not install battery until all maintenance has been performed on engine.

⚠ CAUTION

Refer to FLUSHING COOLING SYSTEM before starting engine.

1 Verify that all cooling system hoses are connected and tight and all drain plugs are installed and tight.

IMPORTANT: Before launching boat, pull up on manual release valve. Verify that green indicators are no longer extended.

2 Pull up on manual release valve to release pressure from the drain system.

⚠ CAUTION

Manual release valve may not close completely. Ensure valve is completely seated.

3 Verify that air actuator and water drain system pressure indicators have returned to the closed position and that the manual relief valve is completely closed.

4 Inspect serpentine drive belt condition and tension. Refer to Serpentine Drive Belt.

5 Perform all lubrication and maintenance specified for completion Annually in maintenance schedule, except items which were performed at time of engine layup.

⚠ CAUTION

When installing battery (in next step), be sure to connect positive battery cable to positive (+) terminal and negative (grounded) battery cable to negative (–) battery terminal. If battery cables are reversed, damage to electrical system WILL result.

6 Install fully charged battery. Clean battery cable clamps and terminals to help retard corrosion. Coat terminal connections with a battery terminal anti-corrosion agent.

⚠ CAUTION

DO NOT operate engine without cooling water being supplied to seawater pickup pump or water pump impeller will be damaged and subsequent overheating damage to engine may result.

7 Start engine and closely observe instrumentation to ensure that all systems are functioning properly.

8 Carefully inspect entire engine for fuel, oil, water and exhaust leaks.

9 Check steering system, shift and throttle controls for proper operation.

CA442

Troubleshooting

Starter Motor Will Not Crank Engine, Or Cranks Slow

Possible Cause	Remedy
Battery switch turned off.	Turn switch on.
Remote control not in neutral position.	Position control lever in neutral.
Open circuit breaker or blown fuse.	Check and reset circuit breaker or replace fuse.
Loose or dirty electrical connections or damaged wiring.	Check all electrical connections and wires (especially battery cables). Clean and tighten faulty connection.
Bad battery.	Test and replace if bad.

CC1033

Engine RPM Decreases, Will Not Rise Above 2000 RPM

Possible Cause	Remedy
Guardian Mode.	Have an Authorized Mercury MerCruiser Dealer check trouble codes to determine fault.

CC1043

Engine Will Not Start, Or Is Hard To Start

Possible Cause	Remedy
Improper starting procedure.	Read starting procedure.
Empty fuel tank or fuel shutoff valve closed.	Fill tank or open valve.
Engine flooded.	Do not attempt to start engine for at least 5 minutes. Refer to Starting Procedures.
Faulty ignition system component.	Service ignition system.
Clogged fuel filters.	Replace filters.
Stale or contaminated fuel.	If contaminated, drain tank. Fill with fresh fuel.
Fuel line or tank vent line kinked or clogged.	Replace kinked lines or blow out lines with compressed air to remove obstruction.
EFI System Fault.	Have EFI System checked by an Authorized Mercury MerCruiser Dealer.
Faulty wire connections.	Check wire connections.
Lanyard Stop Switch activated.	Check Lanyard Stop Switch.

CC1044
Engine Runs Rough, Misses And/Or Backfires

Possible Cause	Remedy
Idle speed too low.	Have EFI system checked by an Authorized MerCruiser Dealer.
Faulty ignition system component.	Service ignition system.
Clogged fuel filters.	Replace filters.
Stale or contaminated fuel.	If contaminated, drain tank. Fill with fresh fuel.
Kinked or clogged fuel line or fuel tank vent line.	Replace kinked lines or blow out lines with compressed air to remove obstruction.
Flame Arrestor plugged with foreign material.	Clean Flame Arrestor.
EFI System fault.	Have EFI System checked by an Authorized MerCruiser Dealer.

CC1045
Poor Performance

Possible Cause	Remedy
Throttle not fully open.	Inspect throttle cable and linkages for proper operation.
Damaged or improper propeller.	Replace propeller
Excessive bilge water.	Drain and check for cause of entry.
Boat overloaded or load improperly distributed.	Reduce load or redistribute load more evenly.
Boat bottom fouled or damaged.	Clean or repair as necessary.
Flame Arrestor dirty.	Clean Flame Arrestor.
EFI System fault.	Have EFI System checked by an Authorized MerCruiser Dealer.

CB825

Excessive Engine Temperature

Possible Cause	Remedy
Seacock closed.	Open.
Drive belt loose or in poor condition.	Replace or adjust belt.
Seawater pickups obstructed.	Remove obstruction.
Faulty thermostat.	Replace.
Coolant level low in closed cooling section.	Check for cause of low coolant level and repair. Fill system with proper coolant solution.
Heat Exchanger Cores plugged with foreign material.	Clean Heat Exchanger.
Loss of pressure in closed cooling section.	Check for leaks. Clean, inspect and test pressure cap.
Faulty seawater pickup pump.	Repair.
Seawater discharge restricted or plugged.	Clean exhaust elbows.

CC1046

Low Engine Coolant Temperature

Possible Cause	Remedy
Faulty thermostat.	Replace.

CC1047

Low Engine Oil Pressure

Possible Cause	Remedy
Insufficient oil in crankcase.	Check and add oil.
Excessive oil in crankcase (causing it to become aerated).	Check and remove required amount of oil. Check for cause of excessive oil (improper filling, bad fuel pump).
Engine oil cooler hose kinked causing excessive oil temperature and thinning of the oil.	Oil Cooler restricted. Straighten hose or replace, if damaged.
Diluted or improper viscosity oil.	Change oil and oil filter, using correct grade and viscosity oil. Determine cause for dilution (excessive idling, faulty fuel pump).

CA450

Battery Will Not Come Up On Charge

Possible Cause	Remedy
Excessive current draw from battery.	Turn off non-essential accessories.
Loose or dirty electrical connections or damaged wiring.	Check all associated electrical connections and wires (especially battery cables). Clean and tighten faulty connections. Repair or replace damaged wiring.
Alternator drive belt loose or in poor condition.	Replace and/or adjust.
Unacceptable battery condition.	Test battery.

CA901

Remote Control Operates Hard, Binds, Has Excessive Free-play Or Makes Unusual Sounds

Possible Cause	Remedy
Insufficient lubrication on shift and throttle linkage fasteners.	Lubricate.
Loose or missing shift and throttle linkages.	Check all throttle linkages. If any are loose or missing, see Authorized Mercury MerCruiser Dealer immediately.
Obstruction in shift or throttle linkages.	Remove obstruction.
Shift or throttle cable kinked.	Straighten cable or have dealer replace cable if damaged beyond repair.

CA902

Steering Wheel Turns Hard Or Jerky

Possible Cause	Remedy
Low power steering pump fluid level.	Refill system with fluid.
Drive belt loose or in poor condition.	Replace and/or adjust.
Insufficient lubrication on steering components.	Lubricate.
Loose or missing steering fasteners or parts.	Check all parts and fasteners if any are loose or missing, see Authorized Mercury MerCruiser Dealer immediately.
Contaminated power steering fluid.	Drain and replace.

CA453

Power Trim Does Not Operate (Motor Doesn’t Run)

Possible Cause	Remedy
Blown fuse.	Replace fuse.
Loose or dirty electrical connections or damaged wiring.	Check all associated electrical connections and wires (especially battery cables). Clean and tighten faulty connection. Repair or replace wiring.

CA454

Power Trim Does Not Operate (Motor Runs But Drive Unit Does Not Move)

Possible Cause	Remedy
Trim pump oil level low.	Fill pump with oil.
Drive unit binding in gimbal ring.	Check for obstruction.

Owner Service Assistance

Local Repair Service

Always return your Mercury MerCruiser powered boat to your local Authorized Dealer, should the need for service arise. Only he has the factory trained mechanics, knowledge, special tools and equipment and the genuine Quicksilver parts and accessories* to properly service your engine should the need occur. He knows your engine best.

* Quicksilver parts and accessories are engineered and built by Mercury Marine, specifically for Mercury MerCruiser® sterndrives and inboards.

Service Away From Home

If you are away from your local dealer and the need arises for service, contact the nearest Authorized Dealer. Refer to the Yellow Pages of the telephone directory. If, for any reason, you cannot obtain service, contact the nearest Regional Service Center. Outside the United States and Canada, contact the nearest Marine Power International Service Center.

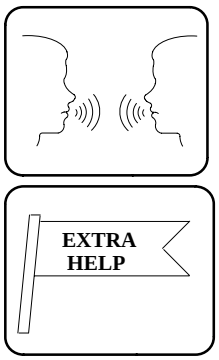
Parts And Accessories Inquiries

All inquiries concerning Quicksilver replacement parts and accessories should be directed to your local Authorized Dealer. The dealer has the necessary information to order parts and accessories for you should he not have them in stock. Only Authorized Dealers can purchase genuine Quicksilver parts and accessories from the factory. Mercury Marine does not sell to unauthorized dealers or retail customers. When inquiring on parts and accessories, the dealer requires the **motor model** and **serial number(s)** to order the correct parts.

CA904

Resolving A Problem

Satisfaction with your Mercury MerCruiser product is very important to your dealer and to us. If you ever have a problem, question or concern about your power package, contact your dealer or any Authorized Mercury MerCruiser Dealership. If additional assistance is required, take these steps.



1 *Talk with the dealership's sales manager or service manager. If this has already been done, then contact the owner of the dealership.*

2 *Should you have a question, concern or problem that cannot be resolved by your dealership, please contact Mercury Marine Service Office for assistance. Mercury Marine will work with you and your dealership to resolve all problems.*

The following information will be needed by the service office:

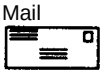
- Your name and address
- Daytime telephone number
- Model and serial numbers for your power package
- The name and address of your dealership
- Nature of problem

Mercury Marine Service Offices are listed on the next page.

CA915

Mercury Marine Service Offices

For assistance, call, fax, or write. Please include your daytime telephone number with mail and fax correspondence.

Telephone	Fax	Mail 
United States		
(405) 743-6566	(405) 743-6570	Mercury MerCruiser 3003 N. Perkins Rd. Stillwater, OK 74075
Canada		
(905) 567-MERC (6372)	(905) 567-8515	Mercury Marine Ltd. 2395 Meadowpine Blvd. Mississauga, Ontario Canada L5N 7W6
Australia, Pacific		
(61) (3) 9791-5822	(61) (3) 9793-5880	Mercury Marine Australia 132-140 Frankston Road Dandenong,Victoria 3164 Australia
Europe, Middle East, Africa		
(32) (87) 32 • 32 • 11	(32) (87) 31 • 19 • 65	Marine Power - Europe, Inc. Parc Industriel de Petit-Rechain B-4800 Verviers Belgium
Mexico, Central America, South America, Caribbean		
(305) 385-9585	(305) 385-5507	Mercury Marine - Latin America & Caribbean 9010 S.W. 137th Ave. Suite 226 Miami, FL 33186 U.S.A.
Japan		
81-53-426-2500	81-53-423-2510	Mercury Marine - Japan 283-1 Anshin-cho Hamamatsu Shizuoka, 435-0005 Japan
Asia, Singapore		
5466160	5467789	Mercury Marine Singapore 72 Loyang Way Singapore 508762

CA463

Customer Service Literature

English Language

English language publications are available from:

Mercury Marine
Attn: Publications Department
W6250 West Pioneer Road
P.O. Box 1939
Fond du Lac, WI 54936-1939

Outside the United States and Canada, contact the nearest Mercury Marine or Marine Power International Service Center for further information.

When ordering be sure to:

1. List your product, model, year and serial number(s).
2. Check the literature and quantities you want.
3. Enclose full remittance in check or money order (NO C.O.D.'s).

CA781

Other Languages

To obtain an Operation and Maintenance Manual in another language, contact the nearest Mercury Marine or Marine Power International Service Center for information. A list of part numbers for other languages is provided with your power package.

caa781

Andre sprog

Kontakt det nærmeste Mercury Marine eller Marine Power International servicecenter for oplysninger om hvordan du kan anskaffe en Betjenings– og vedligeholdelsesmanual på et andet sprog. En liste med reservedelsnumre for andre sprog leveres sammen med din power–pakke.

cab781

Andere talen

Voor het verkrijgen van een Handleiding voor gebruik en onderhoud in andere talen dient u contact op te nemen met het dichtstbijzijnde internationale servicecentrum van Mercury Marine of Marine Power voor informatie hierover. Een lijst met onderdeelnummers voor andere talen wordt bij uw motorinstallatie geleverd.

cac781

Muut kielet

Saadaksesi Käyttö– ja huolto–ohjekirjoja muilla kielillä, ota yhteys lähimpään Mercury Marine tai Marine Power International huoltokeskukseen, josta saat lähempiä tietoja. Moottorisi mukana seuraa monikielinen varaosanumeroluettelo.

cad781

Autres langues

Pour obtenir un Manuel d’utilisation et d’entretien dans une autre langue, contactez le centre de service après–vente international Mercury Marine ou Marine Power le plus proche pour toute information. Une liste des numéros de pièces en d’autres langues accompagne votre bloc–moteur.

cae781

Andere Sprachen

Um eine Betriebs– und Wartungsanleitung in einer anderen Sprache zu erhalten, wenden Sie sich an das nächste Mercury Marine oder Marine Power International Service Center. Eine Liste mit Teilenummern für Fremdsprachen ist im Lieferumfang Ihres Motors enthalten.

caf781

Altre lingue

Per ottenere il manuale di funzionamento e manutenzione in altra lingua, contattate il centro assistenza internazionale Mercury Marine o Marine Power più vicino. In dotazione con il gruppo motore, viene fornito l’elenco dei codici prodotto dei componenti venduti all’estero.

cag781

Andre språk

Ytterligere informasjon om bruks– og vedlikeholdshåndbok på andre språk kan fås ved henvendelse til nærmeste internasjonale servicecenter for Mercury Marine eller Marine Power. En liste over delenumre for andre språk følger med aggregatet.

cah781

Outros Idiomas

Para obter um Manual de Operação e Manutenção em outro idioma, contate o Centro de Serviço Internacional de “Marine Power” (Potência Marinha) ou a Mercury Marine mais próxima para obter informações. Uma lista de números de referência para outros idiomas é fornecida com o seu pacote de propulsão.

caj781

Otros idiomas

Para obtener un Manual de operación y mantenimiento en otro idioma, póngase en contacto con el centro de servicio más cercano de Mercury Marine o Marine Power International para recibir información. Con su conjunto motriz se entrega una lista de los números de pieza para los otros idiomas.

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Andra språk

För att få Instruktions– och underhållsböcker på andra språk, kontakta närmaste Mercury Marine eller Marine Power International servicecenter, som kan ge ytterligare information. En förteckning över artikelnummer på andra språk medföljer ditt kraftpaket.

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Αλλες γλώσσες

Για να αποκτήσετε ένα Εγχειρίδιο Λειτουργίας και Συντήρησης σε άλλη γλώσσα, επικοινωνήστε με το πλησιέστερο Διεθνές Κέντρο Σέρβις της Mercury Marine ή της Marine Power για πληροφορίες. Το πακέτο ισχύος σας συνοδεύεται από έναν κατάλογο αριθμών παραγγελίας για άλλες γλώσσες.

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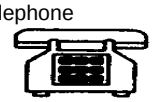
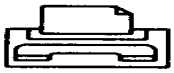
Before ordering literature, please have the following information about your power package available:

Model _____ **Horsepower**_____
Serial Number_____ **Year**_____

United States and Canada

For information on additional literature that is available for your particular Mercury MerCruiser power package and how to order that literature contact your nearest dealer or contact:

Mercury Marine

Telephone 	Fax 	Mail
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Contact your nearest dealer or Marine Power Service Center for information on additional literature that is available for your particular Mercury MerCruiser power package and how to order that literature.

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